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ABSTRACT

This study is the first assessment of the long term effects of computer conferencing. The use of PLANET and FORUM are described, and major users and conference characteristics are presented through excerpts from conference transcripts. Part I of the report focuses on the ways in which organizations used computer conferencing. Conference size and duration for each major user are characterized as to organizational style derived from transcript excerpts. In Part II, patterns of growth of the user population, message sending, the use of commands, and the use of time are examined, and "message sending" in synchronous and asynchronous computer conferences are compared with those in audio conferences and face-to-face meetings. Questionnaire responses from the user population are summarized in Part III. Conclusions are presented and discussed in terms of eight issue areas: (1) the relationship between cost and usage patterns, (2) size of the user base, (3) conference logistics, (4) leadership patterns and skills, (5) user working patterns and skills, (6) organizational adaptation, (7) management support, and (8) computer conferencing as a form of group communication. Appendices include usage and cost data, a summary of questionnaire responses, and a listing of Institute for the Future publications relating to computer conferencing. (RAO)

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GROUP COMMUNICATION THROUGH COMPUTERS

Volume 4: Social, Managerial, and Economic Issues

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About the general exhilaration several have commented upon. I don't think it can be PLANET, if PLANET is indeed to us laymen a super-teletypewriter. . . . We are used to more marvelous machinery than that. Nor do I think that it is the mere meeting, even among worthies such as we all. Would the electricity and excitement be there if we all walked into some hotel ballroom for a conference? Mildly doubtful. I postulate that the fun stems from communication between what is essentially a new life-form in the physical world--pure unembodied creatures that have escaped the strictures that all bodied creatures have to contend with . . . even voices, which are physical-sense body extensions.

--Richard Bach

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This effort could not have been carried out without the assistance of many persons at the Institute and elsewhere. We are particularly indebted to Carreen Jensen and Jeanne Muzzicato for typing; to Roberta Edwards for providing the illustrations in this report; and to Anthony Muzzicato who had the patience to sort out the complex accounting for the project. Dr. Roy Amara, as president of the Institute, provided the guidance and the administrative structure that made the effort possible.

Outside the Institute, we have received much support from numerous individuals in user and vendor organizations, notably at Tymshare, Texas Instruments, Telenet, and Bolt Beranek and Newman. But the major credit for the effort must go to all the users of FORUM and PLANET, whose names will appear throughout this document. We convey to them our appreciation for their willingness to experiment with a novel form of communication and for their patience with the system they came to call "Jennie."

SUMMARY

The development of a mode of communication that would rely on the structuring, filing, and retrieval ability of the digital computer has long been a technical dream. Several such systems have been built and demonstrated in recent years. However, much uncertainty still surrounds the question of which organizations will be able to use these services effectively. In the last two years, we have performed the first large-scale, direct investigation of this question by conducting extended observations of approximately 500 members of more than 18 organizations that used computer conferencing. Among these organizations were NASA, the U.S. Geological Survey, ERDA, and the Kettering Foundation. We have worked with them in an effort to identify the most important social, managerial, and economic issues in the long-term use of this new form of communication. A total of 5,400 user hours has been analyzed in depth.

The conferences observed during this study ranged in size from 2 to 61 participants and in duration from 1 week to 24 months (though detailed statistics were collected for only 18 months). They ranged in cost from less than $100 to almost $7,000. Applications included topical conferences on food and climate, individually-guided education, technology transfer, and psychic research. Several conferences were devoted to the management and coordination of technical projects, while others focused on tasks such as joint report writing. Some of the communication patterns in these conferences seemed to depend on the particular organization which sponsored them: public and private message-sending rates, use of editing characters, time spent outside normal working hours, and synchronous usage all differed from organization to organization. Other patterns such as the use of commands, the time spent typing, and the public "verbosity," seemed independent of organizational differences. In almost all cases, however, these patterns evolved over the study period.

Based on user statistics, conference transcripts, and questionnaire responses, we are able to identify the following issue areas:

1. *The relationship between cost and usage patterns*. The cost of computer conferencing is a significant factor in determining patterns of usage and should not be underestimated. We have identified six primary components of cost, each of which places constraints on users. The average cost per user per month was $38 in our conferences; however, the economic behavior of individual organizations was influenced by patterns of public and private message sending and synchroneity of usage.
2. *The size of the user base*. Computer conferencing will require a very large user base to be economically viable. System usage over the workday has been bimodal, with peaks in the morning and afternoon. The ratio of peak to average usage was measured at a value of 16. For a conferencing service with .99 connection probability, this ratio would be about 7, which is considerably higher than previous projections. We have also found that one cannot assume a Poisson distribution for the arrival of users.
3. *Conference logistics*. Preplanning is at least as important in computer conferences as in face-to-face conferences. A study of the factors leading to success and failure of conferencing applications points to planning as a crucial variable. We have identified three types of issues which are related to improved planning: technical, substantive, and process.
4. *Leadership patterns and skills*. Strong leadership is essential to the effective use of computer conferencing, but leaders of computer conferences will have their own set of tools and skills. Two types of leadership functions have emerged in our observations: organizing and facilitation. The usage patterns of the leaders differ from other users in message-sending rates and typing speed. A general profile of required skills for a good conference leader emerges from these data.

5. *User working patterns and skills*. Users of computer conferencing must develop new communication skills, and this learning process may well extend beyond the 18-month period of this study. Users alter their working process noticeably as they learn to use the medium. New individual skills (such as message composition and editing) combine with new group skills involving organizational and facilitation strategies. A quarter of all sessions occur outside conventional office hours.

6. *Organizational adaptation*. Each organization must develop its own procedures for effective computer conferencing. These will include strategies for dealing with budgeting, training and facilitation, choice of applications, technical options, and sensitivity to social changes, which are likely to be promoted by the introduction of the medium.

7. *Managerial support*. Computer conferencing can support many management activities, but it will not automatically eliminate organizational barriers to communication. The managerial functions supported by computer conferencing included organizing and following-up major meetings, increasing the precision and timeliness of information, supporting or replacing other media, sharing and supplementing data-base utilization, and altering office patterns.

8. *Computer conferencing as a form of group communication*. While computer conferencing has some of the same features as other computer-based services, such as electronic mail, it is a distinct form of communication with its own set of effects on personal as well as organizational patterns of communication. The teams of people who have used the medium have gone through certain typical phases. These phases seem to be related to a perception of the group *as a group*. The communication process via computer conferencing is thus unique in its social impact.

INTRODUCTION

Computer conferencing has recently attracted much attention. Among the benefits cited for this new medium of communication are lower costs for information exchange and expanded opportunities for new working patterns. In particular, travel reduction has been a major incentive for the development of such systems. Over the past few years, several research and development efforts have begun to answer the major questions about the computer science and human factors issues involved in teleconferencing; they have also defined procedures for measuring and monitoring communication through this medium.

This study, however, is the first assessment of the effects of computer conferencing over an extended time frame of two years. Its purpose has been to explore questions about the *long-term* effects of computer conferencing--questions left unanswered by earlier research.

THE MEDIUM

Computer conferencing still requires a definition for many people. In this study, computer conferencing refers to a computer program called PLANET or--in a slightly different version--FORUM. PLANET is accessible from remote computer terminals located anywhere in the United States and in major metropolitan areas in Canada and Western Europe.

Let us assume that you are a participant in one of the test conferences on PLANET. You have access to a computer terminal, and the organizer has indicated that the conference (which we may also call an "activity") is open. The first time you enter, PLANET asks you to type your last name and a personal password. This password prevents others from reading private messages that are sent to you or from making entries under your name. If you are registered in only one conference, you are automatically placed in that conference. However, if you are registered in more than one conference, PLANET prints the title of each of them and asks you to choose which one you wish to enter.* (An asterisk indicates those conferences in which new entries have been made since you last participated.) PLANET then prints an informational heading and the full title of the conference you select as well as a list of participants. Finally, it tells you if anyone else is present at the moment and prints all the entries that have been made since you were last present, notifying you when you are up to date. For example:

```
[6] Mascy  18-Nov-75  11:57 PM
Good morning.  Welcome to the mini-conference.  As the chairman, I
will try to keep the discussion moving so that we can cover all of
the agenda topics.  We will start promptly at 9:30 AM, PDT and end
at 11:30.  Although we should limit our private messages, they can
be used as well as anonymous messages when it is considered in the
best interest of the mini-conference.  An agenda of today's mini-
conference follows momentarily.
```

Once you are in a conference, you can make an entry at any time, even if someone else is already typing. As you type, PLANET automatically assigns a number to your entry, prints your name, and then begins displaying the text as you enter it.

All messages are sent to you automatically as they are finished. If you are not present, they will be printed the next time you enter the activity. In this case, each entry will include the date and time it was started. Once an entry is in the transcript, it cannot be altered, although it can be deleted by the organizer.

PLANET also offers a number of services for experienced users who wish to perform specialized tasks. For example, the STATUS command prints the names of all the participants, the time they last entered the conference, and the last entry they have seen. Other PLANET services allow participants to review previous entries, to submit entries into a private computer file, to join another conference, and to leave the PLANET system.

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*A person may participate in as many as 32 separate PLANET conferences if the organizer of each one has registered that person's name. The number of active participants in any single conference at any one time is limited to 36. The number of registered participants in a conference is limited to 100. There is no limit on the length of an entry or the number of entries in a conference. These rules were imposed for the convenience of system design but have proven adequate in our experience so far.

CREATING A RESEARCH BASE

This system provided the focus for our research. However, in order to build a research base for exploring questions about the long-term use of the medium, we felt that a number of conditions had to be created:

- A stable software environment had to be established so that user groups could rely on the system over an extended period.
- The system had to be widely available through reliable networks so that user behavior could be observed in various cost environments.
- Users had to pay their way through the entire process at *normal commercial rates,* without subsidy other than some "introductory sessions," training, and facilitation.
- Monitoring and analysis software had to be constructed to capture the parameters of the interaction and to display them in a meaningful format.
- A structure for the documentation of user attitudes and the gathering of personal data had to be established without affecting the *in vivo* character of the groups.

The first objective--a stable software environment--was achieved in late 1974 when we began the conversion of our software from ARPANET to TYMNET. A standard program was built from the modules of the earlier FORUM system by retaining only those features which analysis had shown to be essential. The new system was called PLANET (emphasizing the "planning network" potential of teleconferencing), and a small user guide was printed. In mid-1976, we introduced a second version of PLANET on the network of TELENET, Inc., to facilitate comparison of costs.* PLANET-2 offered some extensions of the user language, especially in the area of vote elicitation and feedback. In addition, special versions of FORUM have been used on the computers of the U.S. Geological Survey in Denver and at the University of Stockholm in Sweden.

---

*The implementation of the PLANET system and its optimization was supported by Institute funds, independently of the grant supporting the present research.

One weakness of many computer science studies stems from the fact that usage of the research systems is heavily subsidized. While such subsidies do encourage some initial experimentation, they create an artificial user environment. As a result, few computer innovations sponsored in an academic setting ever make a transition to larger operational settings where they could make the contribution to national productivity intended by those funding the research.

Accordingly, in this project, we emphasized realistic standards of system performance and effectiveness. We also rejected the notion of subsidizing PLANET usage. None of the project funds went towards participant salaries, and computer charges were largely supported by user organizations. To encourage users to pay their own way, we established the following policy: we would offer introductory sessions free to any group which was seriously considering the concept of computer conferencing and which represented a potentially valid field test for this project. Free documentation (in the form of article reprints and a user guide) was also made available. Beyond this introduction, however, we asked that any group interested in using PLANET-1 or PLANET-2 open its own account with the computer service vendor. They would then be billed directly for their use of the program on a monthly basis.* Actual access to the PLANET program was controlled by a validation process in which the user's account was placed on a list of valid accounts kept by PLANET. Thus, the offering of PLANET through commercial networks remained experimental.**

Figure 1 shows the percentage of PLANET usage supported by the National Science Foundation over the period of this study. Early in the

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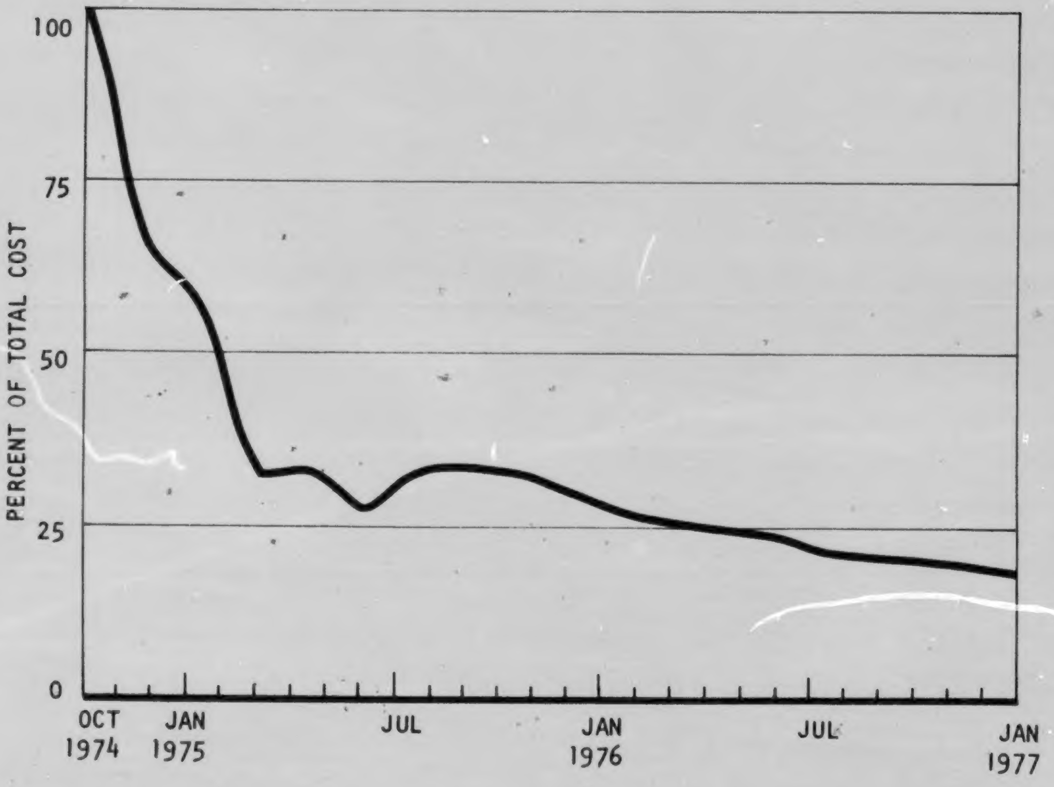
*Appendix A summarizes the economic data gathered during the project.

**In order to make the service available to the users beyond the time of this grant, the PLANET software has now been licensed to a commercial organization. During this project, however, the Institute received no royalties for the use of PLANET.

FIGURE 1

PERCENT OF CUMULATIVE PLANET COSTS
SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION



project a large proportion of conferences was supported by NSF funds, but in the second year of the study, NSF funds were used only for demonstrations and introductory sessions. In the last six months, the Institute's own account was completely discontinued. Thus, we are reporting on over $80,000 worth of test data,* at a cost to NSF of only $15,000. The difference was funded by the users themselves--illustrating a transfer of the computer conferencing concept out of the "laboratory."

To meet our fourth objective of monitoring the interaction in computer conferencing, we needed more software. It is important to note that *the conferencing program which is visible to users represents only one of three levels of software implemented by our project.* At the second level is a sophisticated monitor program that gathers usage statistics across account boundaries every five minutes. It began permanent operation in its present form in July 1975. The information generated by the monitor is identical for all versions of PLANET and is combined, month by month, onto a single magnetic tape.

At the third level of the system is the TCA, or Teleconference Analyzer, which allows us to query the data base of usage statistics. This program is capable of aggregating user-oriented information for all participants, all accounts, and all activities. It yields percentages, rankings, and correlations among monitor variables such as length of private and public messages, typing speed, duration and cost of session, time of day, and use of commands and editing characters.**

In addition to these statistical measures, we have complete transcripts for many of the conferences.*** These allow us to evaluate the public interaction qualitatively. While we have not systematically analyzed the content of these transcripts, we have used them to explore a number of questions which require a knowledge of *what* was said.

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*This figure does not include storage costs and some overhead costs, which probably place total cost to users at over $100,000. Direct charges for terminal leasing by user groups would also have to be added to that sum.

**A full description of the monitor and the TCA is given in ITM-90; see Appendix D for a full list.

***Both transcripts and monitor statistics are preserved as internal technical memoranda at the Institute. These are listed in Appendix D and are available to interested researchers for their own projects, and we certainly encourage the use of the data we have accumulated.

Finally, to document the attitudes of users, we developed and administered two questionnaires: a first "baseline survey" was completed by January 1, 1976, and a second was completed one year later. These surveys probed users' attitudes and reactions to the system in a way similar to our earlier survey of FORUM users.* Questionnaire responses were gathered from 118 of those who used FORUM or PLANET during the study. These questionnaires were sent only *after* users had had experience with the system; the decision to require users to pay their own way meant that we could not demand as much pretest information as we might have with subsidized participants. For example, we could not gather baseline data on communication patterns before the use of PLANET began. Our goal was rather to provide a "low profile" evaluation effort which made no attempt to influence the types of uses which were pursued. The reactions which were gathered in this manner have been correlated with actual usage statistics from the monitor.

ABOUT THIS REPORT

This report, then, describes the use of the PLANET and FORUM systems by almost 500 users. (Table 1 provides a summary overview of this usage.) In Part I, we identify the major users and characterize some of their conferences with excerpts from transcripts. In Part II, we use monitor data to consider patterns of usage. In Part III, we focus on the reactions gathered by the baseline surveys. And finally, in the concluding section, we interpret the implications of our findings for the effective use of computer conferencing in the future.

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*The baseline questionnaire actually evolved over four years. Several of the questions were developed in conjunction with the Communications Studies Group (CSG) in London in order to facilitate comparison with their evaluations of audio and video teleconferencing. A copy of the questionnaire is included in Appendix B. Its use in other studies is encouraged; no permission is required from the Institute for this use, but comparison of results is invited.

TABLE 1. FORUM/PLANET STATISTICAL SUMMARY FOR JULY 1975 TO DECEMBER 1976

	FORUM/PLANET	Sweden*
Total Number of Users	484	174 (Approx.)
Total Number of Hours	4,687	1,221
Public Messages	22,382	3,352
Private Messages	17,369	2,257
Percent Private	43.7%	40.2%
Total Number of Sessions	37,909	16,082
Sessions per User	78	92 (Approx.)
Average Session Duration	10 Minutes	7 Minutes
Total Synchronous Time	1,058 Hours	300 Hours
Percent Synchronous	22.5%	24.6%
Average Length of Public Messages	63 Words	63 Words
Average Length of Private Messages	47 Words	39 Words
Commands per Hour	12	22
Edits per Hour	20	39
Percent of Time Spent Typing	40%	21%
Average Typing Speed	20 wpm	18 wpm
Average Cost per User per Month	$38	--
Average Cost per 20 Words Sent	67 Cents	--
Average Conference Size	9 Users	--

---

*The Swedish data, though not analyzed in this report, are given here for comparison. These data cover the months of July through December 1976.

PART I. THE USER ORGANIZATIONS

U.S. Geological Survey
Institute for the Future
Charles F. Kettering Foundation
National Aeronautics and Space Administration
Energy Research and Development Administration
Deer Communications
Lilly Endowment, Inc.
Systèmes Informatiques de Gestion

PART I. THE USER ORGANIZATIONS

Between January 1975 and December 1976, more than 18 organizations used the FORUM/PLANET system for more than 5,400 hours.* These organizations included government agencies, independent research groups, and business organizations. They applied computer conferencing to tasks ranging from the management of satellite experiments to the discussion of issues in education, weather and climate, and technology transfer in less developed countries. Nine percent of the total usage was from cities outside the United States, primarily in Europe. Together, all of these users spent $80,497 on computer conferencing; as Figure 2 shows, almost half of this amount was spent by government agencies.

Five organizations--the U.S. Geological Survey, Institute for the Future, Charles F. Kettering Foundation, National Aeronautics and Space Administration, and the Energy Research and Development Administration--accounted for 77.4 percent of all usage. Another five groups accounted for 19 percent of the usage (see Table 2). In this section, we examine the ways in which these groups used computer conferencing.** In particular, we look at typical conference size and duration for each major user and try to characterize the organizational style with excerpts from transcripts.

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*This figure does not include the Swedish data.

**Use of the system by Stanford Research Institute and the National Library of Medicine is excluded in this section because of lack of access to transcripts.

FIGURE 2

DISTRIBUTION OF USER COSTS

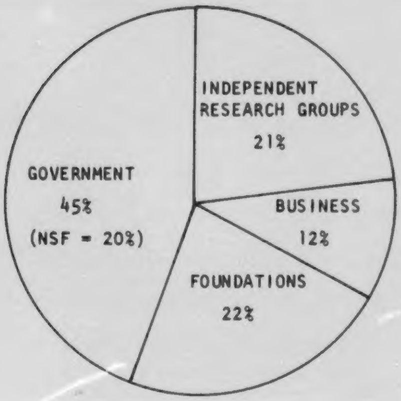

TABLE 2. ORGANIZATIONS THAT USED FORUM AND PLANET BETWEEN JANUARY 1975 AND DECEMBER 1976

Percent of All User Hours	User	User Hours	Cost	Messages Sent		Type of Organization
				Public	Private	
77.4%	USGS	1,109	$14,436	3,690	4,269	GOV
	IFTF	990	15,201	6,777	3,573	RES
	Kettering	892	14,397	5,446	4,480	FON
	NASA	834	13,991	2,759	3,496	GOV
	ERDA	363	3,866	801	695	GOV
18.9%	DEER	358	5,479	2,812	2,301	BUS
	Lilly	259	3,507	1,735	857	FON
	NLM	212	3,635	569	34	GOV
	SRI	100	1,540	912	358	RES
	SIG Clients	93	1,610	631	176	BUS
3.3%	IFTF Clients	63	1,006	503	27	BUS
	ICI	53	832	332	186	BUS
	Lockheed	39	502	260	63	BUS
	EPRI	13	200	40	3	RES
	Tymshare	12	158	55	26	BUS
0.4%	Monsanto	12	77	71	12	BUS
	NDU	3	50	19	1	GOV
	EMF	1	10	28	1	RES
	Total	5,406	80,497	27,440	20,558	

GOV = Government
RES = Research
FON = Foundation
BUS = Business

THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey has been the largest user of computer conferencing over the two-year period of this study. Communication problems in the geosciences are numerous and varied. There is often a need to bring data from remote field locations to a central processing center. As soon as two or more field locations need to interact, the problem of "conferencing" arises. Frequently, an administrative center will participate in the exchange, sometimes raising policy issues. A group of scientists at the Survey--including Allen Clark, Roger Bowen, Joe Botbol, and Gerald Askevold--felt that computer conferencing had particular promise in such an environment. The Institute thus offered PLANET, as well as a special version of FORUM,* to several groups at the Survey and other centers of earth science research in Canada and Europe.

The Survey used computer conferencing for the following conferences between January 1975 and December 1976:

Conference	Dates	Duration (Months)	Participants
COGEODATA Community Miniconference	11-Apr-75 to 14-Jan 76	8	30
FORUM Users Conference	12-Sep-75 to 31-Dec-76	15.5	45
FORUM Demonstration Conference	12-Sep-75 to 31-Dec-76	15.5	61
Alaskan Mineral Resource Program	17-Sep-75 to 31-Dec-76	15.5	13
Alaska Geochemical Workshop	30-Sep-75 to 31-Dec-76	15	15

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*In the spring of 1975, FORUM was modified for the Survey's own computer, allowing USGS personnel to access it. In September 1975, an analysis of system efficiency was conducted, and an upgraded version of FORUM was installed.

Conference	Dates	Duration (Months)	Participants
Northern Great Plains Model	24-Nov-75 to 31-Dec-76	13	14
Standards for Mineral and Fuel Deposit Data	8-Dec-75 to 31-Dec-76	2.5	11
Implementation of GRASP	8-Dec-75 to 31-Dec-76	12.5	15
DEC-10 User Assistance	10-Dec-75 to 31-Dec-76	12.5	39
Mineralogy Users Conference	12-Dec-75 to 31-Dec-76	12.5	39
Data Structures	30-Jan-76 to 28-May-76	5	14
Data Base Users Conference	27-Feb-76 to 31-Dec-76	10	24
Survey of FORUM Usage	7-Apr-76 to 31-Dec-76	8	36
Earthquake Study	7-Jul-76 to 31-Dec-76	6	9
Remote Office	21-Sep-76 to 31-Dec-76	3.5	6

The first uses of computer conferencing by the Survey included some early tests among participants with access to different mineral resource data bases* and a Delphi-like conference on future prices of mineral resources.** Once FORUM was running on the Survey's own computer in Denver, almost a dozen conferences were established. One of these was part of a project to evaluate the mineral resources of certain areas of Alaska. This project had been mandated by Congress as part of the Native Claims and Settlement Act. Under this act, lands designated as "d-2" areas--national interest lands--were to be closed to mining. An assessment of their mineral potential was, however, in order. Three Survey groups were involved in the project under the direction of Hank Berg. They included mineral economists from Reston, Virginia; geologists from Menlo Park, California; and geochemists from Denver.

These three groups used FORUM as a notepad for exchanging information about rock, stream sediment, soil, and vegetation samples. In the summer, several of the geologists, primarily from Menlo Park, conducted field work in Alaska, sending samples to Denver for chemical analysis. The group used FORUM to coordinate and manage the project. In some cases, FORUM also provided a precise record of the technical information exchange. For example:

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*See *Group Communication Through Computers, Volume 2,* p. 37. See also Jacques Vallee, "Network Conferencing," *Datamation,* May 1974, pp. 85-6, 91-2.

**See *Group Communication Through Computers, Volume 3,* pp. 52-5.

[12] Marsh 24-Sep-75 9:03 AM
Good morning. Again, this is Sherm. First a message to Bill Brosge: I have just sent you a hand plot of the zinc values for the Chandalar quad and have done some crude anomaly outlines. It seems that there are two belts of zinc values running east-west along the northern edge and one roughly through the middle. I would like to know what you make of this.

[16] Curtin 24-Sep-75 9:44 AM
Thanks Don Singer for sending me your notes on the geochem in the SW corner of the Tanacross quad. I'm doing some similar stuff now to see what kind of a picture I can get for the whole quad. To Helen Foster and Don Singer: We are still in the process of working the last few bugs out of the Tanacross stream sediment data set.

[92] Malloy 14-Nov-75 11:36 AM
I have a message for Don Singer and Gary Curtin from Helen Foster: Jim Barker is going to be in Menlo next week and so we may be calling you, Don. I will also try to ask him some of the other questions we had. He said that should be 7 and not 8 Porphyry coppers. Taurus was considered as two (east and west) and there was another about 10 miles from Taurus.

In January 1976, a discussion of complex schedules and equipment needs for Alaskan field work occupied the participants in this conference:

[108] Malloy 8-Jan-76 2:46 PM
Hank has asked for a Philip Smith budget for next summer. We are asking for 200 hours helicopter time out of which we hope to get 30 hours for geology, 20 for gravity and 150 for geochemistry. This is based on your last year's rate of sampling and your recent guess that 650 samples per quad would be OK. In any case, funds limit us to 180-200 hours. How does it sound to you?

We budgeted four field assistants for you--GS5--32 hours overtime each per pay period. OK?

Tentative schedule: (a) Marsh et al. begin work at Galbraith June 1--probably finish by July 4-10. (b) Brosge and Reiser at Barter Island June 15-30. Arrive QIRH Dutro at Galbraith July 1-4. Then take over ship for 10 days after you are finished. (c) Detterman arrives Galbraith from Talkeetna July 10-11 to work with us. (d) Dave Barnes et al. arrive sometime in late July. Work in Philip Smith and probably also in Chandalar. How on all that??

[124] Berg (Org) 12-Feb-76 11:50 AM
From Bill Brosge: We should figure on 45 days of helicopter beginning July 1, with a good chance of a 10-day extension. That means 135 hours with a possibility of 30 hours extension.

> I figure that at last summer's rates it would take you 135 hours and 30 days to collect 600 samples in Philip Smith, plus about 15 hours extra for lost travel time if we have to work from Happy Valley.

Complex scheduling needs also led to a series of international computer conferences, this time using the PLANET system on the Tymshare network (see Figure 3). The first of these conferences was in preparation for a Paris meeting of the Committee on Storage, Automatic Processing, and Retrieval of Geological Data (COGEODATA). COGEODATA has been one of the most active users of computer conferencing in the geosciences. The members of this committee of the International Union of Geological Sciences include representatives of the United States, Canada, England, Sweden, Denmark, Norway, and the Netherlands. They began using PLANET with a planning conference to arrange a computer workshop at Oxford and two major face-to-face meetings of UNESCO in Paris in November and December 1975. This conference not only rescued the Canadian organizers of the Europe meetingsfrom a long mail strike; it also helped the participants define the paraeters of the computer systems to be demonstrated at the Oxford workshop and to resolve numerous technical difficulties in the preparation of software and data tapes to be exchanged during the meetings. Surprisingly, the conference continued to grow rapidly during the December meeting, when all the main participants were together in Paris but felt a need to "stay in touch" with their home bases. Furthermore, a second computer conference, structured around the need for international standards for computer applications in resource studies, was also initiated. *To our knowledge, this use of PLANET represents the first instance when computer conferencing has been used to prepare and follow up a major international face-to-face meeting.*

The follow-up conference focused on an important Canadian document related to the international standardization of mineral and fuel deposit data bases. This subject was first introduced during a face-to-face discussion at the UNESCO meeting, but there was not adequate time in Paris for resolving the numerous issues raised. The PLANET conference thus became a convenient "meeting room" for a project known as IGCP Project 98.*

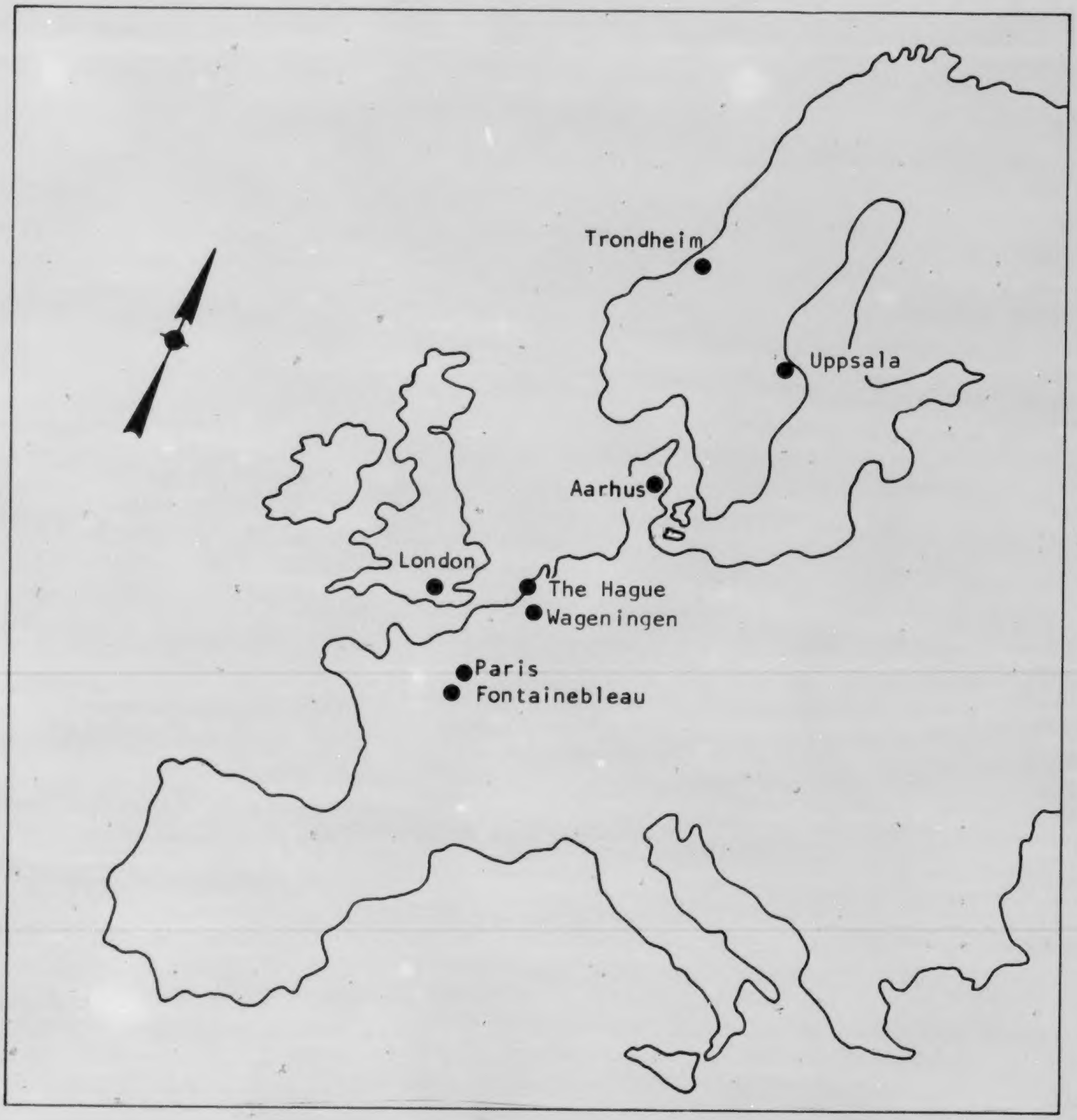
---

*IGCP is the International Geological Correlation Programme, a scientific enterprise carried out cooperatively by UNESCO, USGS, and other geological organizations.

FIGURE 3. EUROPEAN USERS OF PLANET

International computer networks have expanded to the point where effective teleconferencing can be conducted at reasonable rates among many countries.

The circles on this map show the locations of major centers of geoscience research where the PLANET system has been used for communication with scientists in Canada and in the United States during our project.



The objectives of this project were summarized in a conference entry by Neil Burk in Ottawa:

> [130] Burk 1-Feb-76 6:08 PM
> FULL TITLE OF PROJECT: Standards and guidelines for application of computer-based information systems to the study and assessment of global mineral and fuel resources.
>
> PROPOSED BY: Allen L. Clark, U.S. Geological Survey.
>
> MAIN OBJECTIVES: The objectives will be to produce a detailed brochure on three general topics:
>
> A. General principles and specific details for the application of computer-based information systems to study and assessment of resources.
> B. Advantages and costs of various levels of commitments, especially minimum, based upon the technological and monetary capacity of the country.
> C. Methodology of data collection, storage, retrieval, and use, especially display, as they apply to resource studies. This would also define requirements for genetically and materially different resources.
>
> ESTIMATED DURATION: Three to five years, the time being largely dependent upon participation of developing and third world countries.

Another outgrowth of the Paris meetings was a conference to discuss the implementation of GRASP--Geological Retrieval and Storage Program. This program was originally developed to serve the special needs of geologists within the U.S. Geological Survey. However, its use for a large data file on oil and gas wells in Colorado suggested that GRASP deserved a wider audience. Accordingly, a PLANET conference was created to distribute the system informally outside the Survey.

The GRASP conference lasted just over a year--from 8 December 1975 to 31 December 1976. The participants represented the U.S. Geological Survey, the Geological Survey of Canada, the Netherlands Soil Survey and IWIS-TNO in The Hague. The Dutch experience with the program is well illustrated by the following entries:

> [19] Bie 18-Mar-76 12:47 AM
> Following the first trial with GRASP on a large data file (the Soil Analysis File with 22,000 records each with 115 variates) we have had a very positive response from potential users. It looks as if this is what they have been waiting for, but so far have been unable

to do. There are now 4 or 5 scientists writing project descriptions which require the use of GRASP. They can, at least, get at the hard data in a reasonable way. This is a gratifying sign to us, as it must be to the makers of GRASP, who no doubt had just this kind of use in mind. Over the coming weeks, we shall have to give instruction courses to a number of them to enable them to do their own thing. So, we are progressing, not only at the implementation level.

[20] Bie 22-Mar-76 6:14 AM
In our efforts to make a workable system for Dutch earth scientists, we have just begun the implementation of G-EXEC in earnest. We shall link GRASP and G-EXEC, so that files may pass between the two. I am now in The Hague, and Keith Jeffery and Elizabeth Gill are upstairs working away on the CDC version with Kees Benshop and Nico Hofstede. So it is a small world.

It is difficult to capture the range of the Survey's applications of the medium in one or two conferences. The geologists used PLANET and FORUM for sharing data bases, for joint writing efforts, for group problem solving, and for organizing face-to-face conferences. They used it to raise policy issues and to open new channels for the dissemination of scientific information. Finally, they explored its potential for increasing freedom in office location, for supplementing other media, and even replacing other media.* Perhaps most illustrative of the latter was the use of PLANET during the Canadian mail strike:

[67] Garrett 21-Oct-75 5:45 AM
Well, it has happened. The strike started early this morning. It could be a long mail strike--this is where PLANET will prove it's worth.

Here the chairman and secretary of COGEODATA were losing contact with their membership in other countries a few weeks before an international meeting in Europe; an assistant to one of the organizers began using PLANET to disseminate instructions to other research centers:

[76] Gunn 23-Oct-75 1:12 PM
From Neil Burk:

The postal strike in Canada has left me with a number of problems in organizing the Paris meetings, and I'll need the help of some of you (via PLANET) to keep things going. One problem concerns distribution of the Second Circular. About 20 people have not received copies,

---

*These applications are examined in more detail in Jacques Vallee, Gerald Askevold, and Thaddeus Wilson, *Computer Conferencing in the Geosciences*, Institute for the Future, September 1977.

> some of them speakers, and it is important that they receive this information soon.
>
> At least 10 copies of the Second Circular have been sent to each COGEODATA member, and most of you could make photocopies if necessary. Using these resources, I am asking the following PLANET participants to contact their nearest COGEODATA member and/or make arrangements for insuring that the named registrants receive a copy soon. I will not provide addresses now except for a few cases. Please ask if they are needed.
>
> [89] Hutchison 27-Oct-75 6:42 AM
> Keith: I will not be coming to the workshop. Neil and I are splitting our responsibilities on this trip to Europe.
>
> [90] Hutchison 27-Oct-75 6:44 AM
> To all participants in the COGEODATA symposium: it is essential that as many people as possible preregister for the symposium so that we will have enough funds to pay our bills in Paris. We have committed all our funds to assist in travel. Consequently, I would appreciate it if conference participants would spread the word to register and send in money. Moreover, the postal strike is on in Canada and all registrations are being sent through Allen Clark's office in Washington (Reston). Anyone requiring a registration form, leave a message for me and we will have one sent by some devious means.

To our knowledge, this is the first use of a computer network to circumvent the effects of a strike. It is one example of the important social, regulatory, and legal implications of teleconferencing. Eventually, evaluations of the medium will have to go beyond the details of group process and technical design to consider these implications.

INSTITUTE FOR THE FUTURE

The Institute for the Future has used computer conferencing in three ways during this study: (1) to train new users and facilitate conferences for the extended field tests (supported by NSF funds), (2) to coordinate internal projects (supported by Institute funds), and (3) to coordinate activities with Institute clients (supported by client funds). Excluding training and facilitation, the major conferences were:

Conference	Dates	Duration (Months)	Participants
SIG/IFTF Conférence de Coordination	1-Oct-74 to 21-Sep-76	11	7
PLANET Management Project	31-Mar-75 to 31-Dec-76	17	6
Social Assessment of Computer Conferencing	31-Mar-75 to 5-Sep-75	6	15
Pilkington Brothers Conference	30-Apr-75 to 31-Dec-76	19	6
Communications Studies Group/IFTF	17-Jun-75 to 27-Aug-75	2	9
Kettering Foundation/IFTF Coordination	20-Nov-75 to 11-Mar-76	3.5	5
AT&T/IFTF Coordination	28-Jan-76 to 18-Feb-76	1	6
Celanese Corporation/IFTF	27-Feb-76 to 19-May-76	2	3
Preliminary Conference on Privacy	31-Mar-76 to 30-Jul-76	4	5
Privacy Project	2-Apr-76 to 30-Jul-76	4	10
Scenario Discussion I	13-Jul-76 to 31-Dec-76	5.5	5
Scenario Discussion II	2-Aug-76 to 31-Dec-76	5	6
Imperial Chemicals/IFTF	19-Aug-76 to 24-Sep-76	1	10

As this list shows, many of the Institute's conferences were quite brief. Frequently, these conferences focused on short-term projects which were conducted by staff member Andrew Lipinski for corporate clients. The participants used the system to discuss the details of a report--what it should include, when it should be delivered, and how it would be used. In some cases, first drafts of the project report were typed directly into the conference to meet very short deadlines or to get more immediate feedback from the client on additional points to be covered. Typically, the motivation for using computer conferencing in this fashion was time savings: it was faster and more convenient than any mail option.

A number of conferences ran for several months. Some of these, such as the 17-month PLANET Management Project, resembled the notepad-style conferences of the USGS. Other conferences actually substituted for face-to-face meetings on joint projects. For example, two conferences were established as part of a project to develop a set of scenarios for the use of teleconferencing media. The two co-principal investigators were traveling a lot during the early months of the project; they agreed to manage the project and develop the early drafts of the scenarios in these conferences. Also, a consultant in Southern California could take a more active role in the project by using PLANET. After the first drafts of the scenarios had been entered, members of the project team began their critique as follows:

> [46] Johansen 25-May-76 10:10 PM
> Re JV scenarios: re 21 last paragraph: I like the emphasis on face-to-face as providing diversity of experience. This has big implications for the pedagogy of the conference--which I think needs to be described in more detail.
>
> [47] Johansen 25-May-76 10:13 PM
> Re 23: Why Paris? Why not an area where the food crisis actually is intense? The "straight in the eye" quote is a natural for a lead-in on the pedagogy of the face-to-face meeting.
>
> [54] Vallee (Org) 26-May-76 10:30 PM
> On Bob's "Why Paris?" question, I wanted to stick to our scheme of the three different cultures and I used Paris as the intermediate one, also it is a traditional focus for "neutral" negotiation (e.g., Vietnam peace talks). Now that I think more about it, there are strong parallels between the positive and negative face-to-face scenarios and I think it's a good thing: the same aspects that provide opportunities in some cases can have disastrous effects in others. Some of these parallels I have deliberately emphasized to show how sensitive face-to-face is to personalities.

The use of computer conferencing during the early phases--in addition to providing a "meeting place" for traveling team members--provided a record of almost all of the major conceptual issues which were raised. This record made it easier to document the project methodology. Of course, the project was not completed without face-to-face meetings. When philosophical differences arose, an intense face-to-face session seemed to be more comfortable. Also, as the project moved to questions of format and "fine-tuning" of the scenarios, face-to-face was judged more efficient since the members of the project team were all in the same location.

The Institute users of computer conferencing have been particularly sensitive to the way in which the medium is used and have frequently recorded their reactions in conference transcripts. In the scenario discussion, for example, one participant commented on a sense of divisiveness in a synchronous ("real-time") conference:

> [243] Vallee (Org) 30-Jun-76 7:05 PM
> Do you have the feeling right now that this medium is promoting disagreement among us rather than encouraging us to seek a ground for consensus?
>
> [245] Shirts 30-Jun-76 7:07 PM
> Re 243: I do not think it is necessarily promoting disagreement. It is just so slow that it is very difficult to consider ideas as complex and rich in possibilities as we are doing now. If we could stay on here for four hours, I think it would work out in the end.

At another point, one of the project members pointed out the potential of the medium to create a feeling of pressure on individuals in the group:

> [131] Shirts 4-Jun-76 6:07 PM
> I have discovered an effect of computer conferencing which seems to me could be quite important in some situations. You may already be familiar with it but I haven't heard it mentioned in our conversations. Since returning from Palo Alto, I have had a "hardball" schedule which has made it difficult for me to take the time to respond to what is happening on the terminal. However, I did check in each day.
>
> When I would check in and find everyone working on the scenarios, the pressure began building to make a contribution. The terminal was becoming a kind of rate-setter.
>
> [132] Shirts 4-Jun-76 6:10 PM
> There are hundreds of teams of people around the country working on various writing projects. There are also many people who are stalled, blocked, lazy, or ineffective on those teams. Could the terminal be

used, with everyone's knowledge, as a means of helping people produce, of setting a pace of work, of prodding the slower members of a team? Would a person quickly develop ways of dismissing the impact of other people's work? "Well, they're doing a lot of writing, but they aren't producing much of quality."

[133] Shirts 4-Jun-76 6:13 PM
Is the effect peculiar to me, to persons with a work ethic, or is it generalizable to many different people and cultures?

We have gathered users' reactions to computer conferencing using questionnaires; these are reported in Part III of this report. However, comments such as these provide insights into the feelings of participants *while they are actually involved in the communication*. A more complete analysis of the transcripts would therefore undoubtedly augment the results gathered from questionnaires.

CHARLES F. KETTERING FOUNDATION

The Charles F. Kettering Foundation of Dayton, Ohio, is a nonprofit organization which devises ways for diverse individuals and institutions to come to grips with major social problems. Its activities focus primarily on elementary and secondary education, urban and international affairs, and scientific research on ecological concerns. Many of these activities require close collaboration with other groups in the United States and abroad; hence, the Foundation relies on numerous conferences for development and ongoing coordination.

Two years ago, enticed by articles on teleconferencing systems in publications such as *The Futurist,* Kent Collins of the Kettering Foundation began to explore the new media to determine whether they could be applied to its program activities. This exploration resulted in a series of prototype computer-based conferences. The primary intent of these conferences was to give the Foundation's program staff direct exposure to the medium by using it to meet established communications needs, some of which had previously been fulfilled through mail, telephone, and face-to-face meetings.

The Foundation made PLANET available to groups it sponsored for two types of conferences: (1) ongoing planning and coordinating conferences and (2) briefer topical conferences of the "seminar style." It is important to keep in mind that a different cast of characters was involved in each conference: school teachers, climatologists, city managers. There is some justification, however, for treating Kettering usage under a single organizational heading, because a core group from the Kettering staff managed all of these conferences. This group had an opportunity to learn from each conference and build on that learning. The major Kettering conferences are listed below:

Conference	Dates	Duration (Months)	Participants
Planning Kettering Conferences	2-Mar-76 to 31-Dec-76	10	11
Kettering Project Management	2-Apr-76 to 31-Dec-76	9	4
Global Food/Climate Study	2-Apr-76 to 13-Jul-76	3.5	11
Professionally Isolated Schools	7-May-76 to 24-Jun-76	1.5	13
Individually Guided Education	25-Jun-76 to 26-Oct-76	4	11
Colorado Plateau Research Project	25-Jun-76 to 25-Aug-76	2	9
Internal City Managers Association	23-Aug-76 to 20-Oct-76	2	16

The conference on the Global Food/Climate Study is an example of a successful seminar-style conference. Organized and chaired by Dr. Eric Walther, this conference considered the ecosystems producing various crops in the United States and Canada; it resulted in a report showing the changes in yields which might occur in multiyear sequences of favorable, unfavorable, or variable weather.*

The issues before the group were made clear by the organizer in an entry at the beginning of the conference; these issues included some questions of topic selection:

> [2] Walther (Org) 5-Apr-76 5:40 AM
> Early in the report, there must be discussion and justification for our choice of crops. We chose corn, wheat, soybeans, and sorghum, but we excluded barley.

There were also some questions of priorities:

> We must discuss forage production on range lands in North America. We all agreed on its importance, but we did not push for its quantification with respect to our climatic scenarios. We cannot ignore this discussion because the use of forages and feed grains by animals we eat accounts for almost 90% of the total grain ingested by North Americans, according to Lester Brown.

---

*Dexter Hinckley, *Impact of Climatic Fluctuation on Major North American Food Crops*, Institute for Ecology, July 1976.

The main body of the conference covered the period from 5 April to 10 June 1976 and dealt with many questions of data-gathering, integration, and presentation:

> [40] Hinckley 14-Apr-76 7:47 AM
> The printout for Canadian wheat has arrived from McCloud, and I will use it to develop a bar graph similar to those we already have. However, I would like a good figure for Canadian wheat crop area in 1975. Also, should we use any years other than those we have used for the U.S. crops? I do not know if I will have time to work up the barley.

The participants also drafted and approved a press release in the course of the conference:

> [55] Hinckley 14-Apr-76 11:34 AM
> The following is a draft of a press release for the briefing on April 29th: Impacts of Climatic Fluctuation on U.S. Food Production. For release April 26, 1976. Contact: Dexter/Hinckley [etc.] for further information.
>
> Prolonged droughts now affecting crop lands and range lands in the western U.S. should remind us that we do not control all the components of food-producing systems. We can determine the area under cultivation; we can apply modern agricultural techniques; weather still has very important effects on the quality and quantity of food produced.
>
> Dependence of high food production on continued good weather is the subject of a briefing being held at 2 p.m. on April 29 in room 4221 of the Dirksen Senate Office Building. The briefing will be conducted by Dr. Louis M. Thompson of Iowa State, Dr. Darrell E. McCloud of Univ. of Florida, and Dr. Eric G. Walther of the Kettering Foundation in Ohio. They will summarize scenarios developed to show what would happen to production levels for corn, wheat, sorghum and soybeans if climatic fluctuations observed since 1933 recurred during the next decade. They will also present preliminary recommendations of national strategies to increase and apply knowledge needed to cope with the impacts of climatic fluctuations.

This statement of the issues helped focus the PLANET discussion. It also raised questions about the arrangements for the briefing. The medium was used to work out some of the details:

> [67] Walther (Org) 15-Apr-76 7:32 AM
> Concerning the briefing of congressional staffers on 29 April, the press release from T.I.E. puts the responsibility on Louis, Darrell, and myself. Darrell won't be able to contribute to preparations until his return on 26 April. I believe we should have an overhead transparency projector available for our use during the briefing. We should be able to display some yield series and the tabular form of our analysis.

> Dick, I would appreciate your making sure the projector will be available. Also, have you and Dexter prepared any nicely drawn graphs of the yields or any drafted tables? If not, then all we have right now is the computer plots of the yields and Dexter's handwritten tables.

From such organizational and practical details, the discussion frequently went to fundamental problems concerning weather data or analytic methods. It is impossible to give a complete description of the intense exchange that took place among this group, but the above entries may have captured the spirit of the discussion, which resulted in a published report. We consider it a major success that the weather and food experts used computer conferencing purely as a tool, taking the computer system very much for granted.

The system was also easily integrated into the workstyles of participants in a conference chaired by Ms. Lyn Simmons. This conference dealt with "Individually-Guided Education" (IGE). The participants in this case were state and local educational agency consultants in Florida, Alabama, New York, South Dakota, Minnesota, and Georgia. Not all of them had met previously, but they had all been trained by Kettering's Institute for Development of Educational Activities. Fifty percent of the participants in this conference were women.

The group leader defined the focus for each phase of the interaction and provided a schedule for completion of that phase; such discipline has emerged as an indispensable factor in our observations of the dynamics of conferencing groups:

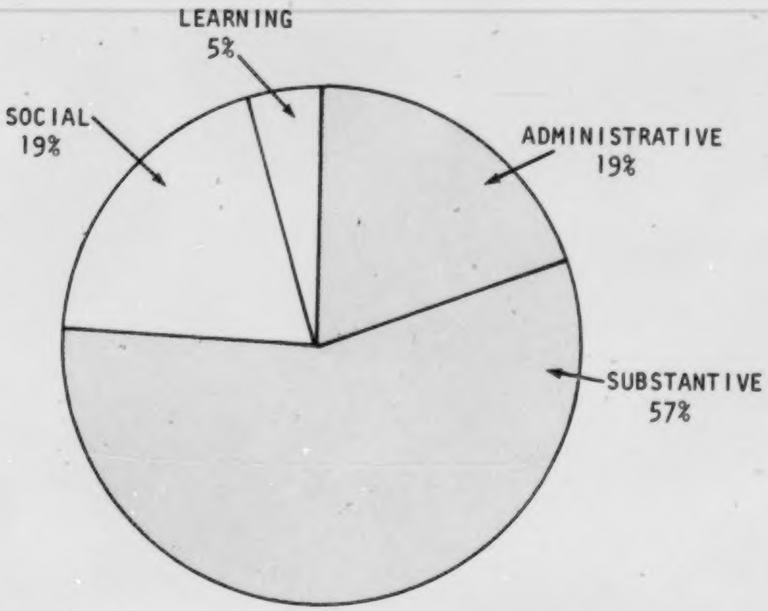
> [99] Simmons (Org) 29-Jun-76 10:14 AM
> To review objective one:
>
> To establish a communications network of facilitators for sharing ideas and critiquing plans.
>
> To put the suggested activities in the perspective of a time line:
>
> 1. Getting to know your activities--mostly June 28 & 29 and ongoing as appropriate.
>
> 2. Sharing background of IGE, i.e., how did you get involved, when and where did you go through a clinical and at what level, what is the nature of your intermediate agency?--June 28 - July 2.

3. Describe your target population for IGE implementation, i.e., how many schools will you work with, what level are they, what is their knowledge of and commitment to IGE?--June 28 - July 2.

We have performed an analysis of the contents of this conference, classifying entries as substantive, social, administrative, and learning entries. The results are shown in Figure 4.

FIGURE 4

CONTENT CATEGORIES FOR THE KETTERING CONFERENCE ON INDIVIDUALLY-GUIDED EDUCATION



This conference was unusual in several ways. It was one of the most voluminous conferences, with nearly 1,000 entries in the "substantive" category alone. Also, when we compare it to other Kettering conferences, IGE stands out for the high percentage of entries made outside of normal office hours; this percentage rose slowly throughout the conference to about one-third of the total time. One of the reasons for the extra-office activity may have been the easy access to terminals. All participants had their own portable terminals, and many of them carried them with them. One user reported using PLANET from her home, her mother's and her sister's homes, her office, and a workshop in a neighboring school district; another carried her terminal between her home and office in Miami and also on trips to Tampa and Springfield, Illinois.

The IGE conference also gave PLANET its first nickname. The following entry appeared one morning in the transcript:

> Checking in at 7:55 a.m., C.S.T. shows no new entries since I last talked to "Jennie" . . . by the way, if I am going to swear at something, it has to have a name . . . so this thing has been named Jennie!

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The National Aeronautics and Space Administration began tests with the PLANET system through the Ames Research Center where Mr. Bradford Gibbs, Chief of Communications, was instrumental in getting the first conferences implemented. Initially, PLANET was viewed as an experimental medium to be compared with video and audio teleconferencing facilities already available at NASA. Gradually, the focus of the computer usage became more operational, and by the end of 1975, the system had been used in support of two projects, each involving about 16 scientists in various parts of the country.* Altogether, NASA has used PLANET for five conferences:

Conference	Dates	Duration (Months)	Participants
The Future of Transportation	14-Aug-75 to 1-Mar-76	5.5	19
Government Discussion	9-Oct-75 to 1-Dec-75	2	7
Communication Technology Satellite Conference	17-Oct-75 to 31-Dec-76	17.5	31
Technology Assessment Project	18-Nov-75 to 10-Dec-75	1	12
NASA Principal Investigators Conference	22-Mar-76 to 31-Dec-76	9.5	6

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*These two projects have been described in detail in Jacques Vallee and Thad Wilson, *Computer-Based Communication in Support of Scientific and Technical Work*, Institute for the Future final report to NASA, March 1976; Jacques Vallee and Bradford Gibbs, "Distributed Management of Scientific Projects," *Telecommunications Policy*, December 1976.

In the conference on The Future of Transportation, experts from across the country used computer conferencing to prepare and critique successive drafts of a joint document dealing with inter- and intracity transportation. When the conference got underway, all the participants already knew each other. They had worked together for about six months and had recognized a high need to exchange views. A pilot study using the PLANET system offered an opportunity for improved exchange of information. The study was jointly conducted by the Ames Office of Planning and Analysis and the Communications Branch to evaluate the concept of computer conferencing in an application involving an ongoing inter-agency/university/industry assessment of transportation technology.

The objective of the group, whose members are listed in Appendix C, was to make a series of recommendations concerning research and development for intercity air and ground transportation through the year 2000. Prior to the start of the computer conference, the group met at a conference in Hershey, Pennsylvania, and began circulating drafts of various sections of the report. The purpose of the computer conference was to promote the orderly critique and integration of these documents while keeping face-to-face interaction to a minimum.

Once the conference began, communication among group members rose rapidly. The rate of private message exchange was particularly high, prompted by the existence of two distinct subgroups--government and contractors. The charter under which the group was formed specified that each subgroup would exchange views among its own members in preparing drafts. This mandate encouraged the use of the private mode until integration in the public mode could take place. It also led to the creation of a new activity for the exclusive use of government personnel. As the final part of the conference began in December, all participants were informed of the tasks before them:

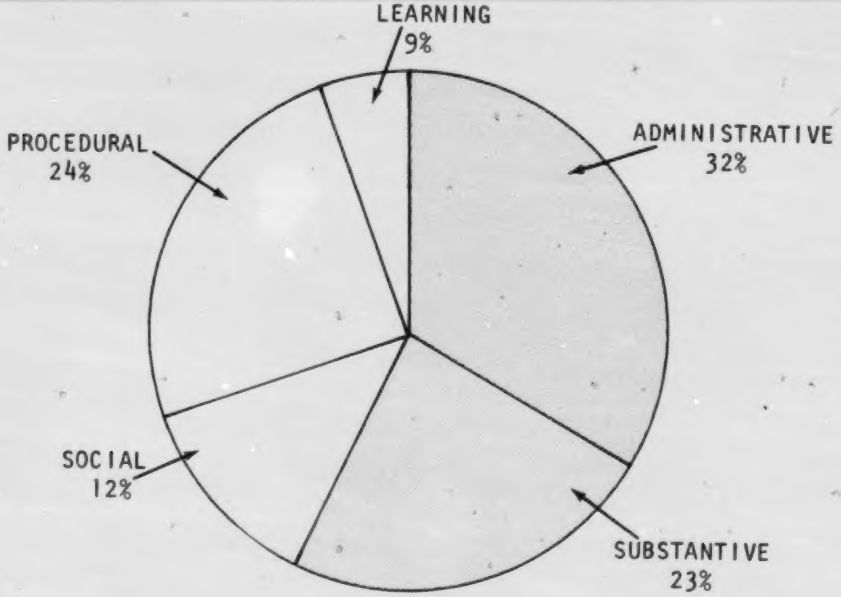
```
[5]  Mascy  2-Dec-75  8:56 AM
. . . To all. . . .  At this time there is only one activity available
to all participants. . . .  There is no separate government channel,
and the mini-conference of November 19 has been erased. . . .  (I have
copies of all public messages on all activities if anyone wishes a
copy.)
```

This conference continued until the end of the project on 29 February 1976.

As for the Kettering conference, we have coded the public entries made during all three parts of this conference. In this case, we have five content categories: learning, procedural, social, substantive, and administrative. Figure 5 shows the percentages of entries in each content category.

FIGURE 5

CONTENT CATEGORIES FOR THE NASA CONFERENCE ON THE FUTURE OF TRANSPORTATION



The Future of Transportation conference ended on 1 March 1976. However, the other pilot project--a conference among experimenters with the Communications Technology Satellite--is continuing at this writing.*

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*A more detailed analysis of this group, focusing on effects on working patterns, is underway as part of another Institute study.

The Communications Technology Satellite (CTS) is a joint U.S.-Canadian mission involving government and industry teams in a series of experiments with advanced communications systems. The initial objectives of the computer conference were defined in an entry by Mr. Brad Gibbs at NASA:

> [90] Gibbs 29-Jul-75 10:01 AM
> We are planning a two-part study on a limited basis, and if it is successful, it will be expanded to a much greater number. My questions at this time only refer to the initial conference for information; we have a CTS users meeting in Cleveland the last part of August at which time all participants in the first conference will be in attendance, which would be a good time to brief them all at once. . . . Specifics for the two sessions are:
>
> 1. Will include 6 participants, 1 at Washington, DC, 1 at Goddard, 2 at Lewis, and 2 here at Ames; will last until October 28; and the system will be used for scheduling of experiments, discussions and reviews of general action items, and the planning of a teleconference experiment involving the four centers.
>
> 2. By the users meeting in October, we would have had enough experience to know whether or not we should expand the conference to include all CTS experimenters for such things as:
>
>   A. Scheduling of Experiment Time
>   B. Status of the Spacecraft
>   C. Reviews of Action Items

This pilot conference, which lasted from 17 August 1975 to 16 October 1975, was successful enough to justify support of a continuing conference. In particular, its usefulness was dramatized by the communications which resulted from successive postponements of the satellite launch date. Some typical entries during this difficult period follow:

> [513] Grayson 1-Mar-76 1:29 PM
> Notice to anyone and everyone!!!!!!!!!!
> Experiment 16 completed a very successful first checkout period this date from 1700 to 1900 GMT. All systems worked exceedingly well, and problems were minor. My sincere thanks to Ames Research Center and to the EC people who helped make this first transmission so successful.

> [333] Lew 12-Jan-76 2:47 PM
> ****************************** To all! ******************************
> In view of the short turnaround between the time that the decision is made (anticipated at noon EST, January 13) and a launch as early as 1821 EST, January 16, it is suggested that all PLANET folk check into PLANET on an hourly basis on January 13, 1976, starting at about 1000 EST.

After the launch, it was decided to continue using the computer conference to more effectively manage the various experiments. In this phase, the discussion took the form of a "collective notepad." Frequent entries broadcast the satellite status and updated experimental schedules to keep the entire group informed. These entries are typified by the following:

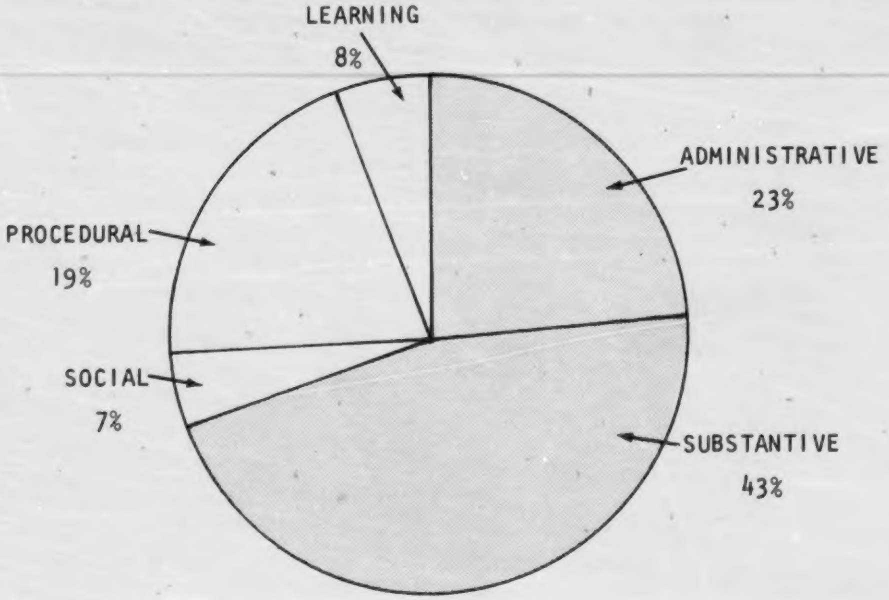
> [382] Hunczak 27-Jan-76 9:26 AM
> CTS mission status. The station acquisition maneuver conducted yesterday to correct the orbit perigee and which changed the S/C drift to 1.54 degrees west (see message 377) was executed on time. S/C location is now slowly approaching its 116 degrees west station. Two maneuvers remain:
>
> 1. January 28, 1976 6:56 GMT to 0.37 degrees/day
> 2. January 29, 1976 6:53 GMT to 0.00 degrees/day on station
>
> Handover of the S/C to Canada will be early in the afternoon (17:00 to 19:00 GMT) on January 29, 1976.

> [402] Baker 30-Jan-76 12:49 PM
> H. Hunczak . . . Here is information you requested from Westinghouse. Lock on the 16-foot antenna step track system at 19:41 GMT on February 3. For those who are looking for other signals, the first planned tests of Transponder will start February 5.

Again, the public entries in the CTS conference were categorized in the same manner as the entries in the transportation conference. Figure 6 shows the distribution of categories over the entire conference to date. The percentages of entries in various categories can be compared for the Transportation and CTS conferences. Learning and procedural entries are quite similar (9 percent and 8 percent for learning, 24 percent and 19 percent for procedural, respectively). The transportation study, however, involved a higher degree of social activity, the smallest of all categories for CTS. The relationship between the two main categories, namely administrative and substantive, was reversed for the two conferences. This reversal could be expected since the transportation group was discussing successive drafts of a substantive report external to the conference, promoting a greater concern for administration, while the CTS group used the computer conference for its substantive work.

FIGURE 6

CONTENT CATEGORIES FOR THE NASA CTS CONFERENCE



The NASA use of the system illustrates the potential of computer conferencing to improve the management of technical information. In particular, the following applications stand out:

- Providing Precision and Timeliness of Information. Requests for data and updates on the status of the spacecraft or the experiments were crucial to the CTS group. For example:

[380] Baker 26-Jan-76 3:22 PM
Is the scheduled time of turning on the beacon (S/C) known at this time? If not, would H. Hunczak please put it on PLANET as soon as it is known? Thanks.

- Replacing Other Media. The system represents an economical alternative to telephone or telex when information of a technical nature needs to be communicated to several people at once. It also offers a retrieval capability:

  [401] Grayson 30-Jan-76 10:35 AM
  Kennard and Chitwood. The subject of a CTS checkout time allocation switch has been agreed between experiment 16 and experiment 20. Chitwood has confirmed this switch for experiment 20. The new schedule should read:

Experiment 20	April 13	1800-1900 GMT
Experiment 16	April 13	1900-2100 GMT

  Jerry, please confirm to both Chitwood and myself that you have entered this change in your computer. Thanks to you and experiment 20.

- Supporting Other Media. In some cases, the system has served to confirm and support information transmitted through other channels, as in this entry:

  [458] Hunczak 13-Feb-76 1:09 PM
  The spacecraft was ranged by Goddard on February 10. Orbital elements were received at Lewis this morning, processed, and the new S/C ephemeris and AZ-EL angles for your ground sites mailed this afternoon at 20:30, February 13. Would like to know when each receive them in the mail.

- Managing Time. The following entry shows the use of the public mode to confirm private communications giving a number of participants a specific time allocation:

  [516] Kennard 2-Mar-76 12:46 PM
  Ippolito, Kaiser, Nunnally, Miller. Time allocations for the week of 3/7-3/13 follow by private message. Please let me know any corrections promptly.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

The Energy Research and Development Administration has been actively involved in computer conferencing since our earlier work with FORUM. We have already reported on an initial application of FORUM in environmental studies conducted at Brookhaven National Laboratory.* The Administration's use was expanded in the period covered here as several ERDA groups concerned with information systems and networking experiments began using PLANET. The users have been primarily physicists, computer professionals, and information scientists. Their conferences include the following:

Conference	Dates	Duration (Months)	Participants
Health/Environmental Aspects of DBER-Response	13-Nov-75 to 27-Sep-76	10.5	16
ERDA Networking Group	7-Jun-76 to 1-Jul-76	1	14
ERDA Information Systems	17-Jun-76 to 16-Oct-76	4	8
ERDA Network Investigators	24-Jun-76 to 31-Dec-76	6	24
ERDA Network Objectives Panel	1-Jul-76 to 31-Dec-76	6	12
Berkeley Data Management System	6-Jul-76 to 31-Dec-76	6	14
Interlaboratory Data Exchange	7-Sep-76 to 31-Dec-76	6	20
National Coal Assessment: Health Effects	6-Oct-76 to 31-Dec-76	3	12
National Coal Assessment: Water Group	8-Oct-76 to 31-Dec-76	3	9

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*See *Group Communication Through Computers, Volume 3*, pp. 30-1; and S. Morris and G. Morgan, *Human Responses to Sulfur Pollutants: Proceedings of a Computer-Based Conference*, Brookhaven National Laboratory, Upton, New York, November 1974.

This report will only consider the general patterns of PLANET usage by ERDA during the project. A more detailed study of the effects of computer conferencing on the working patterns of energy researchers will be published separately as Volume 5 of this series, entitled "Effects on Working Patterns." This later study will contain specific information about the groups within ERDA who have been using PLANET, as well as an analysis of its actual and potential effects on their working patterns.

DEER COMMUNICATIONS

Deer Communications is a company specializing in news magazines for cable television. Mr. Aaron Katz, owner of the company, became interested in the potential of computer conferencing to supplement existing news networks and sponsored a month-long conference on the subject of psychic research. Participants in this conference included Richard Bach (of *Jonathan Livingston Seagull* fame) in Florida and Ingo Swann in New York, as well as researchers from the Université de Montréal and Stanford Research Institute. The conference included a number of experiments, the results of which have been reported elsewhere.* The conference is the largest activity to date with 3,971 messages.** It gives us new insight into the use of the medium for open-ended discussions among users who were not only facile with the technology but were also gifted with literary skills.

A number of the entries focused on the effects of the medium:

```
[145] Bach 22-Jun-75 7:22 PM
More EFFECTS. More convention-hurdling. We hesitate, just having met
a person, to put as our first comment, "What do you think is the nature
of reality?" We are convention bound to comment on the weather, cur-
rent events, where do you live, what do you do for a living, et cetera.
In PLANET I can say, and delight in it, "M. Baudot, what for you is
real?" In this capacity the system is sort of an intellectual Compu-
terMate. You can draw preliminary conclusions about a person in minutes
that take long times to draft face to face, occluded as face-to-face
is with appearance, manner, speech patterns, und so wieder. I called
Gerry Askevold on the phone an hour ago, to see what it would be like
to communicate in that mode (and to check that he was not a clever
construct of Hastings/Vallee). Well, Sally answered the phone in her
lovely voice and we talked a bit and then G.A. and I talked. Cer-
tainly most cordial and friendly, but still . . . still . . . there
are phone conventions, too, and those are barriers as with face-to-face.
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*Jacques Vallee, Arthur Hastings, and Gerald Askevold, "Remote Viewing Experiments Through Computer Conferencing," *IEEE Proceedings,* October 1976, pp. 1551-2.

**However, most of the entries occurred before the PLANET monitor was implemented.

. . . a response . . .

> [157] Hastings (Org) 22-Jun-75 8:08 PM
> Re 145 and talking on the phone or face-to-face: you see, I think we probably could interact with someone face to face just as we do on PLANET. We would probably have to shut our eyes and focus our attention only on our words, and repress lots of nonverbal and automatic interactions. Would this work? I think it would. I think we could say, "What is your view of reality?" and focus on that and interact . . . in face-to-face, just as we do on PLANET. We would have to transfer what we do on PLANET to face-to-face personal interaction.

. . . and more effects . . .

> [148] Bach 22-Jun-75 7:44 PM
> EFFECTS. When the computer is crashed, it is like losing a physical sense: speech/hearing and/or sight. And Ingo's comment, "Good to see you in the system," is a pretty direct sensory reference. The transcript shows us the mettle of each of us, and I was strongly aware, over my evening meal, trying to keep the cats off the table and read the transcript at the same time, how really sharp are the minds in this motley bunch. Made me happy to be a part of it, to be the one soul whose job is to keep the rest of you down to earth is quite an honor for me.

This conference provided one of our best opportunities to push the medium to its very limits. In it, we recorded not only the highest information exchange rate in any of our conferences to date, but also the strongest sense of group commitment.

In another conference sponsored by Deer Communications, three participants played a game simulating an international crisis. These participants were located in five different countries. Although we had conducted such simulations with CRISIS before,* the participants in these previous trials had been located in the same area and the whole conference had been conducted in English. In this new test, one of the fictitious "nations" in the simulation was sending all its public messages in French. User teams were located in Paris (France), Brussels (Belgium), London (England), Montreal (Canada), and in various U.S. locations, notably Santa Barbara, San Diego, and Menlo Park, California. One member provided direct French/

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*Reported in Volume 3 of this series and in the article by Jacques Vallee, "The FORUM Project," *Computer Networks*, vol. 1, no. 1, 1977.

English translation online during the synchronous conference, which lasted for an intense four hours.*

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*The results of the conference, together with a technical analysis and full transcripts, are available by special arrangement (see Appendix D, ITM-78).

LILLY ENDOWMENT, INC.

The Lilly Endowment, Inc., is a foundation with a major concern in the area of education. Dr. John Ferguson of the Education Division had a special interest in developing a communication network to link Endowment-supported projects involving research related to education. Under his guidance, the Endowment supported two conferences:

Conference	Dates	Duration	Participants
Integrated Data Bases in Postsecondary Education	10-Mar-75 to 14-Mar-75	1 Week	20
Conference on Psychological Modeling	10-Sep-76 to 12-Nov-76	2 Months	11

The first conference explored a range of issues associated with the concept of integrated data bases for postsecondary education. While there were many points of agreement during the activity, no votes were taken and no one approached the conference with the idea that a specific and coherent plan of action would ensue. In a real sense, the purpose of the conference was to engender discussion around a critical problem confronting postsecondary education. To that degree, it was successful; but consensus would have required further discussions to sort out the specific problems of data-base integration.

Much of the conference focused on definitional problems. For example:

> [69] Schmidtlein 11-Mar-75 3:26 PM (PDT)
> Pardon us for ignoring the themes of the discussion so far, and pursuing our own line of thought. After all, this is what happens in face-to-face conversations!
>
> Several questions are puzzling us. First, the term IDB seems to be used in several senses by participants. Are we talking about integrating data on subject areas within data systems? integrating existing information systems? integrating users and the technology? integrating the knowledge of people with a common interest? All of these questions have been used by participants, and the use of each definition of the terms poses different problems.
>
> [108] Farmer 12-Mar-75 2:55 PM (PDT)
> In re Schmidtlein 69: Actually the term integration here means integration of the activities of many people, data collectors, data manipulators, and data analysts. Thus, integration should be aimed at activities rather than things. For example, documentation standards would permit us to exchange data bases more readily. Having a single clearinghouse for listing data bases (perhaps like the ASIS Directory of Bibliographic Data Bases) would permit us to know what has been done. Data compatibility will become a goal as we suffer from incompatibility. Thus, we should be trying to integrate efforts to use data rather than integration in the sense of the representation of data in machine readable form; e.g., a particular data management system.

Because the exploration was wide-ranging, there were numerous entries, by both the organizer and participants, which attempted to focus the discussion. As the conference approached the last day, Dr. Ferguson encouraged the group to use PLANET to pick up threads of the discussion which might have been lost in a face-to-face meeting:

> [179] Ferguson (Org) 13-Mar-75 8:54 PM (PDT)
> One other point should be made. Do not feel prevented from making a comment or suggestion simply because your idea pertains to a point in the discussion long since passed. Each entry is fair game, and the computer has the capability to rearrange the logical flow of thoughts afterwards. So, if you want to take issue with entry X, do it! One of the reasons for inviting such a diverse group was to keep each other honest--no sense of preaching to the converted. Another reason was to examine a larger set of issues, so don't feel constricted by the current line of discussion--especially on the last day--instead, feel free to add, delete, challenge, debate, or whatever (even do it anonymously if you must) on any issue. It can only help to strengthen the next steps.

The transcript of this conference was published;* a summary of the conference noted eight guidelines for the "next steps."

The second conference focused on psychological modeling. Philip Spelt, one of its participants, described the group's goals as follows:

> The primary goal of the group was to produce a functional computer simulation of a task that has received attention in the recent psychological literature--developmental transitivity. The plan was to mail copies of relevant articles (by Trabasso and his colleagues) to the participants prior to the start of the conferencing activity. These articles were to be read prior to the start of the computer conference. It was hoped that the participants would enter the initial 24-day computer conference with a good understanding of this literature. The goals of the computer conference were to sharpen individual understanding of the transitivity data and to begin generating one or more models which could be finalized, integrated, and programmed during the 2-day face-to-face meeting at Denison University.**

The entries in this conference illustrate the potential--and limits--of computer conferencing for communicating graphic information:

> [99] Spelt 20-Sep-76 8:35 PM
> I'm going to try to get a flow chart on the system for you all, if this infernal machine doesn't kick me off before I'm done. The messages will be one geometric figure per message. First will be the form (square, diamond, etc.), then what goes inside the form. Then you can all draw your own flow chart. OK?
>
> [100] Spelt 20-Sep-76 8:37 PM
> Start--assuming we aren't going to "teach" the computer (this is the "linear array" model, by the way). Form = box -- input array.
>
> [101] Spelt 20-Sep-76 8:39 PM
> Form 2 = box (arrow from box 1) -- input test pair.
>
> [102] Spelt 20-Sep-76 8:40 PM
> Form 3 = diamond -- Is one test pair an anchor? "Yes" line to the left of diamond, "no" line down.
>
> [103] Spelt 20-Sep-76 8:52 PM
> "Yes line" to later diamond deciding "Are we finished?" (put that in later).

***Teleconference on Integrated Data Bases in Postsecondary Education: A Transcript and Summary*, Institute for the Future, 1975.

**Philip F. Spelt, "Evaluation of a Continuing Computer Conference on Simulation," *Behavior Research Methods and Instrumentation, Volume 9*, 1977, pp. 87-91.

> [104] Spelt 20-Sep-76 8:53 PM
> "No" line down to: form 5 = box -- locate shortest member of test pair.
>
> [105] Spelt 20-Sep-76 8:54 PM
> Form 6 = diamond (arrow from box 5) -- is other member to long side?
>
> [106] Spelt 20-Sep-76 8:55 PM
> "No" arrow from left or diamond 6 back to box 5 (to left of flow chart).
> "Yes" arrow from bottom of diamond 6 to:
>
> [107] Spelt 20-Sep-76 8:56 PM
> Form 7 = box -- print out answer to question and time taken. Arrow to:
>
> [108] Spelt 20-Sep-76 8:57 PM
> Form 8 = diamond -- done with all input pairs?
>
> [109] Spelt 20-Sep-76 8:57 PM
> "Yes" arrow down to oval (form 9), which says "QUIT." "No" arrow back up to box 2 (input test pair).
>
> [110] Spelt 20-Sep-76 8:59 PM
> The above flow chart will, I think, get us started on a "linear array" model. All of you, please draw your own flow chart following the directions I gave and send me a copy to use as part of the evaluation process. Play it straight, as this is a test of the ability of this system to communicate complex concepts, not of your flowcharting ability!

In his own evaluation, Spelt concluded that the conference had played a significant role in preparing the group for the face-to-face conference:

> . . . the preparation of the group for the face-to-face meeting was such that relatively few hours were required to bring all participants to the same relatively sophisticated level of understanding of transitivity phenomena. . . . by lunch of the first full day the group was ready to begin making substantive decisions about the model to be developed.

In spite of the general satisfaction of participants in these conferences, the Lilly Endowment has not indicated any interest in further use of the medium. These efforts were organized by a single individual and that individual has now left the Endowment. Evaluations of these individual conferences do not, unfortunately, tell us much about the organizational barriers to long-term usage of computer conferencing.

SYSTEMES INFORMATIQUES DE GESTION

Systèmes Informatiques de Gestion is a French software company that has worked closely with our project in making PLANET available in Europe. It has helped prepare several conferences in the French language and one international conference in English, which we will be analyzing in this volume. This conference was titled, "Transatlantic Conference on Technology Transfer."

The conference was organized for the European Management FORUM, a business group headquartered in Switzerland. Mr. Norman Solomon, EMF's associate director, served as chairman of the conference whose members included: Professor Ingo Walter, Associate Dean of the Graduate School of Business at New York University; Dr. Valerius Herzfeld, a Univac Vice President; Dr. Dimitri Germidis, a senior economist at OECD, Paris; Mr. James Karuga, Economic Affairs Officer at the United Nations Committee on Trade and Development (UNCTAD), Geneva; Mr. Van den Brink, Philips Pilot Plant manager, Utrecht; Professor Jean Boddewyn, Baruch College, New York; and Messrs. Jéquier, Usui, Delapierre, and Brochet, all with OECD in Paris.

The conference lasted from December 1975 to mid-February 1976 and covered a wide range of issues. Part of the discussion (which was published as a report and distributed internationally*), is given below in summary form.

Each participant was asked to make a preliminary statement to define areas of agreement or disagreement:

> In his opening remarks WALTER (NYU) indicated that technology transfer through MNCs [multinational companies] to LDCs [less developed countries] is simultaneously priced too high and too low. The marginal cost of the transfer (for the MNC) is negligible since the technology is frequently old and the development costs have already been recovered--yet the pricing is often based on average cost. Conversely,

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*N. Solomon, ed., *An International Dialogue on Technology Transfer*, Worldtech Report No. 3, August 1976.

> average cost of developing and maintaining the technology is usually not charged in the case of the LDCs so that the transferring company ends up subsidizing the LDC. This argument suggests that there is no "correct" economic price for technology.

As other participants entered the discussion from locations in Europe and North America, they helped focus the economic issues:

> HERZFELD supported WALTHER's initial comments by suggesting that LDCs should reexamine the use of lower order technology capital equipment in order to gain experience and training at a reasonable cost. Prestige on the balance sheet has less value than good will.
>
> MAISLISCH (UNCTAD) presented his opening remarks by noting that technology is an essential input to production, bought and sold in the world market in the form of capital, intermediate goods, and technical or commercial information. In addition technology can be incorporated in human skills and knowledge.
>
> KARUGA (UNCTAD), adding to these introductory comments, stressed the fact that an information gap existed between the MNCs and the LDCs which made it very difficult for developing countries to negotiate effectively. This imbalance often results in costs to the LDCs which exceed the benefits.

After the introductory phase, there was a phase typical of "seminar"-style conferences when participants work to integrate individual positions. A final phase was marked by entries that often emphasized the political side of the issues which earlier discussion had treated in an economic context:

> WALTER identified the key issue facing the United States today. The U.S. government is no longer promoting massive technological enterprises (e.g., the lunar landing) that capture people's imagination, generate significant political support, condition society to the expectation of and search for technological progress, and throw off major long-term technological benefits. While immediate spinoffs from such programmes may be limited (and hence the source of much criticism), the government's role as a catalyst in technological advancement must not be underrated. There is concern that the United States is becoming politically conditioned to an anti-technology stance, with far-reaching consequences for the welfare of the United States and that of other countries including the LDCs.

In his concluding remarks about this conference, Mr. Solomon offered a number of comments about computer conferencing. As chairman of the technology transfer conference, he observed some social effects specific to the medium:

> With the exception of the two in the United States, participants in the technology transfer conference had never met each other nor did they receive photos of each other until after the conference. They did receive, however, short biographic sketches. Nevertheless, the impersonal nature of the discussion did not limit or constrain effective communication. *The conference demonstrated clearly that emotion can be transmitted without personal contact.* Personalities and relationships did evolve in spite of the distance and the "impersonal keyboard." [our emphasis]

Within a large corporation, the participants could see important future developments stemming from the introduction of computer conferencing. One area of impact was strategy formulation:

> Computer-conferencing can play a useful role in the periodic strategy formulation process of the internationally dispersed firm. Not only can it reduce the need to physically bring the key executives together, it can also go a long way towards alleviating the problems cited above. Instead of forcing the process into one or two days, it can be spread out over a period of two or three weeks. This will reduce the pressure and provide adequate time for a more meaningful response to new proposals and new ideas. It will allow more staff follow-up, at both the home office and the strategic business units when it is needed, thus increasing the confidence level of the key strategic decisions taken.

Finally, it was felt that computer conferencing could lead to a form of network interaction not only among individuals, but among data sources and mathematical models, an idea which we have been actively pursuing* as a logical extension of the work reported here.

> Remote computer-conferencing dramatically expands the knowledge base which can be brought to bear on the discussion by enabling a participant to draw upon other information sources at his leisure. During the conference specialists were occasionally brought into the discussion when the need arose, for example when focusing on the "international patent system" or when referencing specific research projects. Participants can call upon their colleagues when appropriate to formulate a consensus. They can search their own files to verify observations. They can even access other computer data bases in a more sophisticated environment. One could envision the possibilities of exercising a computer-simulation model, available to only one of the participants, to test the consequences of certain sets of assumptions developed by the group.

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*Jacques Vallee, "Modeling as a Communication Process: Computer Conferencing Offers New Perspectives," *Technological Forecasting and Social Change*, vol. 10, 1977, pp. 391-400.

None of the above possibilities are feasible during a face-to-face conference where specific blocks of time are allocated for discussion and where the conference is held remote from the participants' offices or primary sources of information.

PART II. PATTERNS OF USAGE

Growth of the User Population
Message Sending
Use of Commands
Use of Time
Evolution of Organizational Styles
Comparing Media

PART II. PATTERNS OF USAGE

The 500 participants in this study used PLANET or FORUM for a total of 5,400 hours, of which 4,687 hours were monitored by the system, providing the largest set of data on the use of computer conferencing to date. For the first time, it seems appropriate to talk about *patterns* of usage.

In Table 1 in the Introduction, we presented aggregate data for the major parameters of system use. In this section, we look at these statistics in more detail. Specifically, we examine patterns in the growth of the user population, message sending, the use of commands, and the use of time. In the section on the Evolution of Organizational Styles, we trace the development of usage patterns *by each major user* over time. Finally, we compare "message sending" in synchronous and asynchronous computer conferences with those in audio conferences and face-to-face meetings.

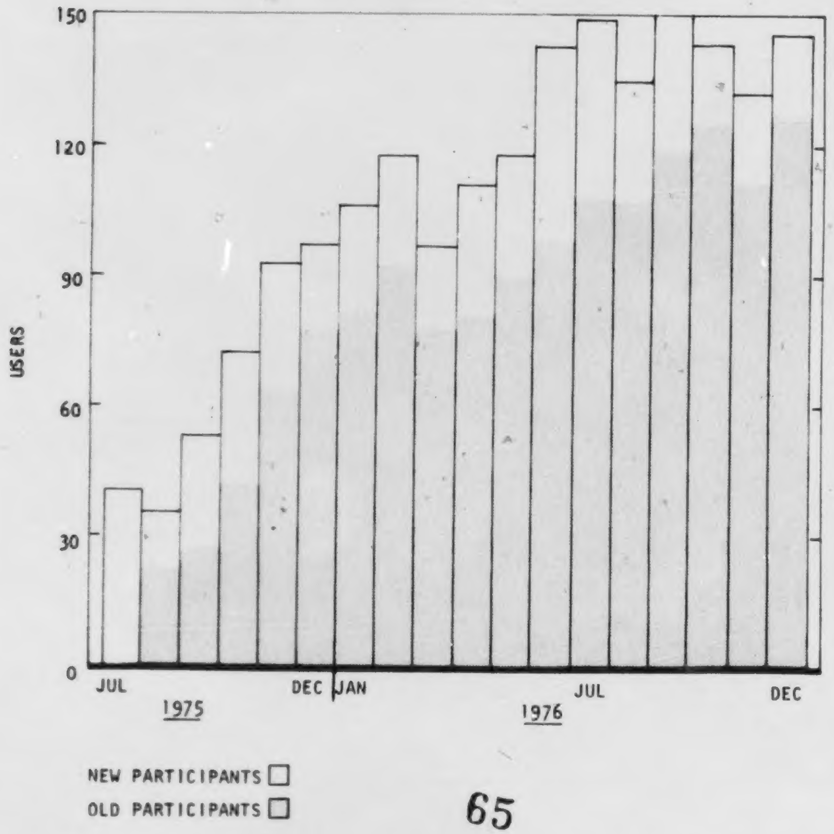
It should be noted that we have not analyzed all conferences in the same way and at the same level of detail. In some cases, we felt that developing a method of analysis was more important than analyzing the complete set of data. Whenever our observations are based on less than the full 4,687 hours of usage, however, we note the user population.

GROWTH OF THE USER POPULATION

Figure 7 shows the evolution of the user population. When the monitor statistics began to be systematically gathered in July 1975, there were 40 users of PLANET and FORUM. The population of conference members can be seen to grow steadily, with about 25 percent of new users each month. Some attrition is visible, too, but in a given month, the great majority of the participants are people who have used the medium before. This situation suggests that we are dealing with a fairly stable user community.

FIGURE 7

NUMBER OF NEW AND OLD PLANET/FORUM USERS EACH MONTH



MESSAGE SENDING

Computer conferencing differs from any other kind of conferencing in two important ways: (1) the opportunity for both public and private message exchange and (2) the opportunity for both synchronous (real-time) and asynchronous (delayed) interaction. The way in which these options are used determines, to a large degree, the style of communication in the new medium. Figure 8 shows the cumulative growth of messages--both public and private messages--between October 1974 and December 1976; private messages typically total one-fourth to one-third less than public messages. Looking just at the 18-month statistics, we find that public messages are sent at a rate of 4.8 per hour and private messages at a rate of 3.7 per hour. The average length of these messages is 281 characters; public messages average 317 characters, and private messages average 235.

The private message mode allows "invisible" networks to develop in a computer conference. For example, Figure 9 shows the network which emerged in a two-hour synchronous conference among geologists in the United States, Canada, and Europe. Such networks grow out of exchanges which may not be related to the group task at all; they reflect the "informal structure," which may not be articulated in the public mode. Private messages may allow the network to develop more quickly and operate more effectively; at the same time, however, they may increase feelings of distrust and tentativeness in the group.

The second option which influences message sending is synchroneity. Face-to-face conferences are necessarily synchronous; everyone must be in the same place at the same time. Computer conferences do not have such a requirement. Users can participate whenever it is convenient. Of course, computer conferences *can* be synchronous,* but even synchronous conferences

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*This ability is one of the major factors which distinguish computer conferencing from electronic mail.

FIGURE 8

CUMULATIVE MESSAGE GROWTH FOR PLANET/FORUM

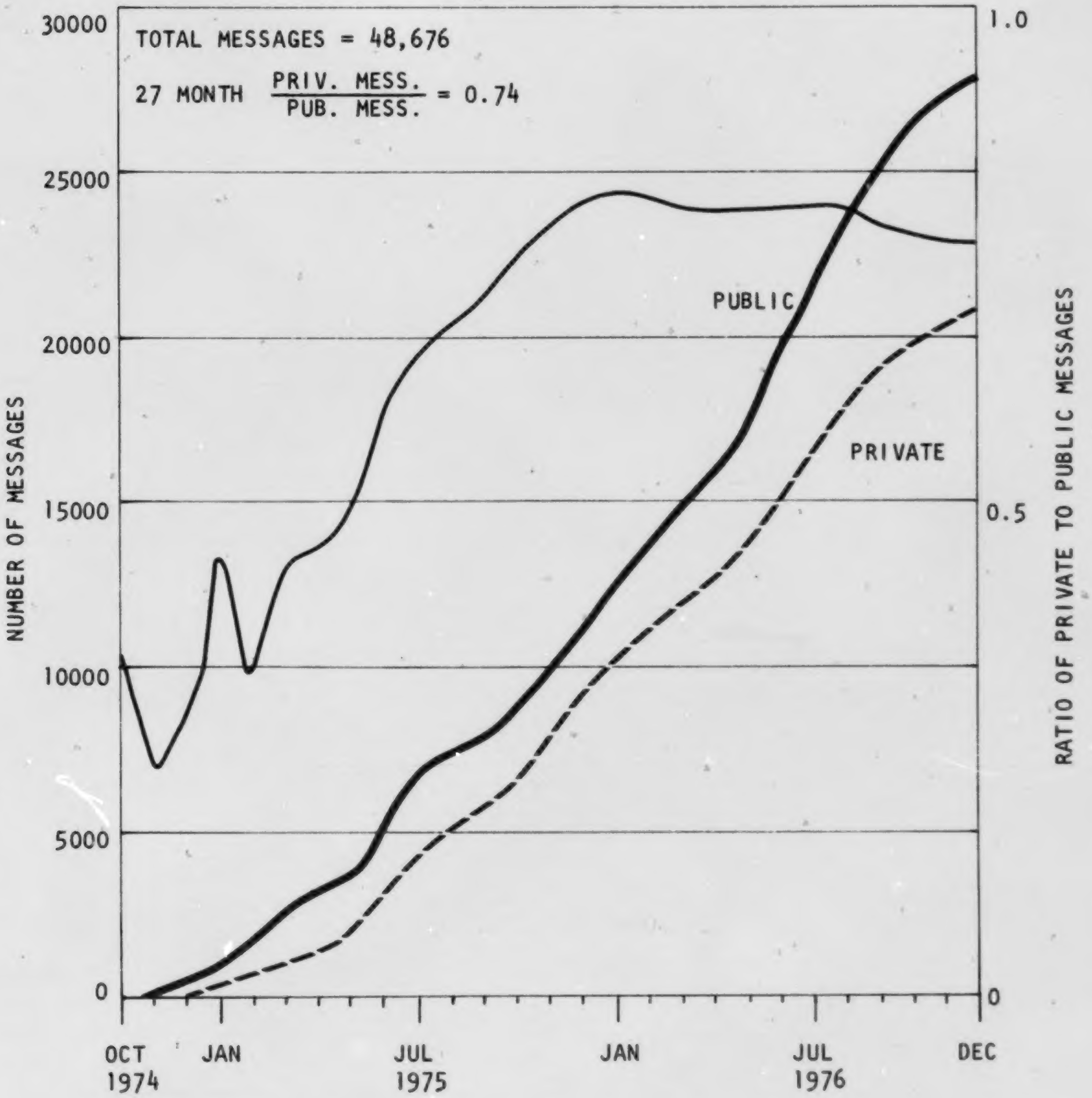
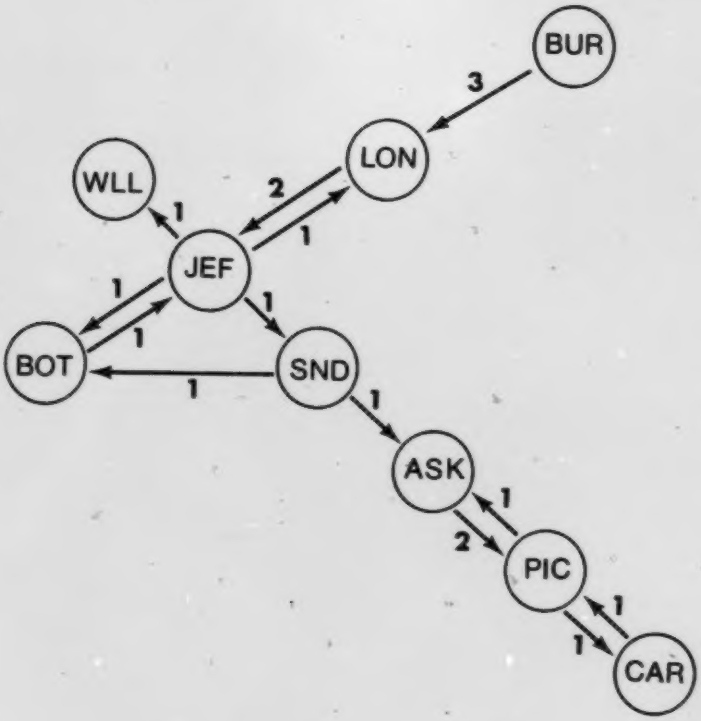


FIGURE 9

AN "INVISIBLE NETWORK" IN A USGS CONFERENCE



are not comparable to face-to-face conferences. Synchronous conferencing constitutes a form of communication with unique features. In particular, it enables several people to "talk" at the same time. Figure 10 illustrates the message-sending activity in a 6-minute portion of a NASA conference. Participants often comment that synchronous conferencing creates a unique social environment and contributes to a feeling of personal contact.

PLANET will support synchronous conferences of up to 36 persons. As the size of the group changes, however, message sending changes, too. The manager of a computer conferencing system will need to be aware of these relationships in order to optimize the service provided to users; within a given conference or activity, the facilitator should also be aware of the effects of group size. For these reasons, we have analyzed our data to examine the rate of message exchange, the percentage of private messages, and verbosity (average message length) as a function of group size.*

Our overall finding is that, as the system moves from a single-user (asynchronous) situation to a conferencing situation, the rate of message exchange doubles and verbosity decreases. The proportion of private messages is highest for dialogue situations (two users online) but decreases for larger groups. These are only general observations, however, and they need to be qualified by reference to a more detailed examination of system behavior.

The rate of information exchange, for instance, follows different patterns in the public and in the private mode. The number of messages per hour doubles as one moves from single-user situations to groups with three or four users. As the group gets larger, however, the rate of private message exchange decreases. When seven or eight users are online, the number of private messages sent per hour is no higher than it was for a single user. (See Figure 11.)

Group size also seems related to the *proportion* of private messages during synchronous interaction. When a single participant uses PLANET,

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*In this study, we recorded 3,000 hours of asynchronous usage (one user), 1,078 hours with two users, 376 with three, 133 with four, 32 with five, 17 with six, 19 with seven, 3 with eight, and 33 with nine.

FIGURE 10

MESSAGE-SENDING TIMES IN A SYNCHRONOUS COMPUTER CONFERENCE

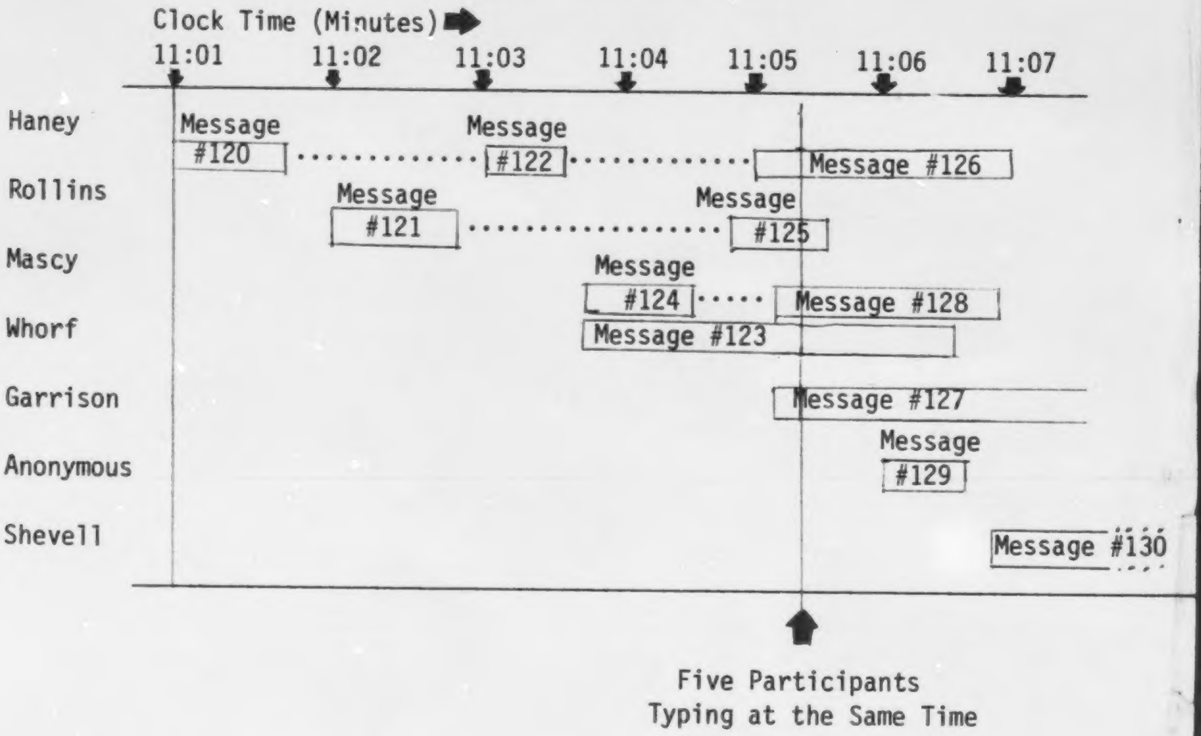
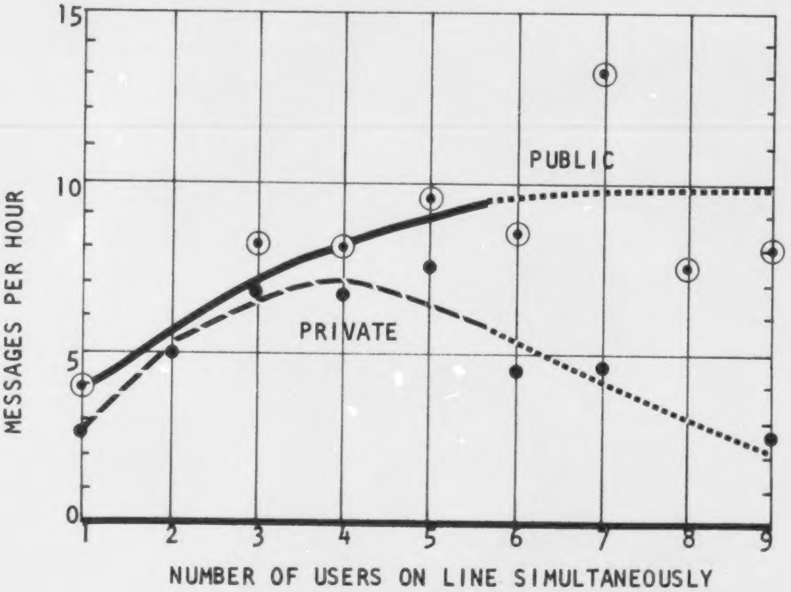


FIGURE 11

EFFECT OF SYNCHRONEITY ON THE RATE OF MESSAGE EXCHANGE



about 40 percent of all messages are private. When a second, third and fourth user joins the discussion, this percentage rises significantly. However, it decreases again when the group becomes large--involving more than six people. Our interpretation for this behavior is that increased group size first increases the social activity reflected in private messages, but tends to create a pressure to "go public" when the group becomes really large. (See Figure 12.)

The average length of messages also varies with group size: while messages sent by single users average over 60 words in the private mode and 70 words in the public mode, the entries made in synchronous interaction decrease in length as the group gets larger. (See Figure 13.) We had observed a similar effect earlier,* but we had not been able to document it as a function of the number of users. Public entries in FORUM decreased from 95 words to 59 words as the discussion changed from asynchronous to synchronous. Private entries decreased from 45 words to 24 words. These early statistics, however, were based on only three conferences.

Group Communication Through Computers, Volume 3, Proposition 7, p. 121.

FIGURE 12

EFFECT OF GROUP SIZE ON PERCENTAGE OF MESSAGES THAT ARE PRIVATE

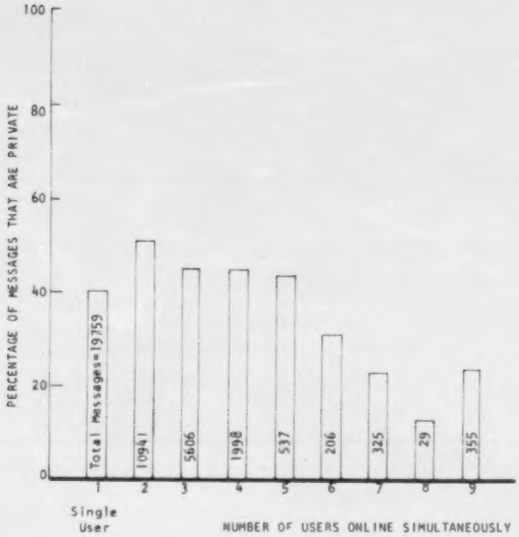
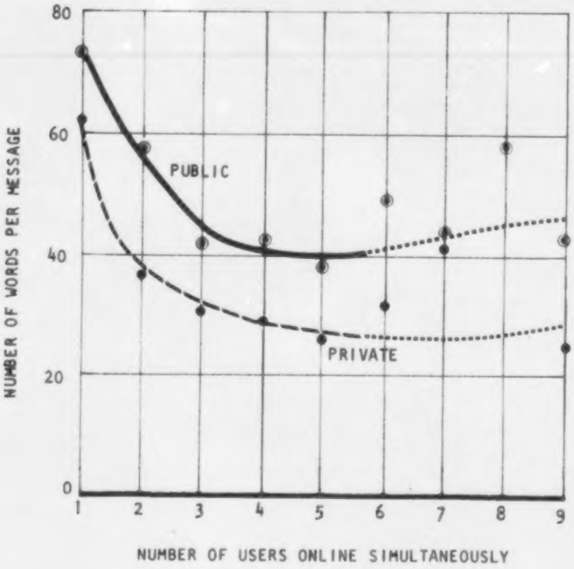


FIGURE 13

EFFECT OF GROUP SIZE ON VERBOSITY



USE OF COMMANDS

PLANET represents a deviation from the traditional "command language" orientation of many information services. In fact, our software design emphasizes the elimination of commands as much as possible. It is not necessary for users to learn any commands to send and receive messages. For editing, commands are incorporated in CONTROL characters. These characters are used, on the average, 18 times per user hour. The CONTROL A, which erases the last character, is used 11 times per hour, followed by CONTROL W (eliminates last word) at 5 times per hour and CONTROL X (for canceling the current entry) at 1.5 times per hour. Other editing characters (for retyping the current entry or the current line, for instance) are used quite infrequently.*

The users had a choice of seven commands. These commands were used a total of 55,000 times during the study. As Figure 14 shows, the QUIT command (which equals the number of sessions) is the most frequent, followed by JOIN and REVIEW. Commands restricted to the organizer have been used infrequently (about once in four hours) and those commands requiring an understanding--or even an *awareness*--of the file system have remained practically untouched.

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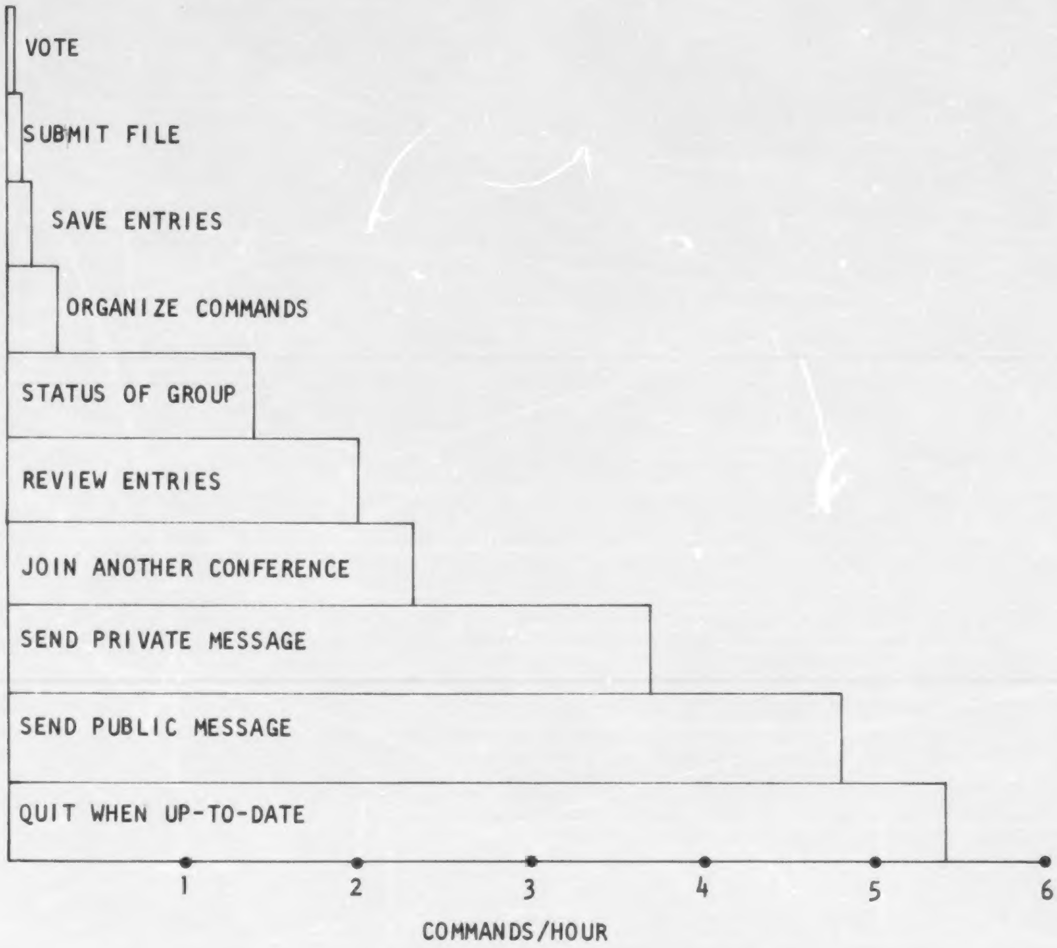
*These statistics are based on a large volume of usage and can therefore be regarded with some confidence. Users have erased the current entry 6,700 times, the last word 22,600 times, and the last character 55,000 times.

FIGURE 14
USE OF COMMANDS



USE OF TIME

In developing a computer conference service and in understanding the way in which it is likely to be used, it is important to consider the effect of the system on the way in which time is used. How frequently do users log into such a system and how long do they remain logged in? What time of day do they prefer to confer? And how do these patterns differ from participant to participant?

There are diverse opinions about how conferencers *should* use their time. Turoff* expects users of the NJIT research facility to stay logged in for about one hour at a time. Englebart, at SRI, has generally indicated longer sessions to be desirable; such patterns would, according to him, lead to the appearance of professional "information experts" in government and industry.** (Both the NJIT system and the SRI system, however, offer text editing and document preparation, an area which was deliberately not addressed by PLANET.) In earlier work on the ARPANET, we reported that the average length of a session was 25 minutes for synchronous sessions and 13 minutes for asynchronous sessions. This observation changed when we moved to a commercial network with significant costs to the users. Eighty percent of all sessions now last less than 10 minutes. The average length of a session for the 18-month usage has been 7.2 minutes, of which 2.9 minutes are spent typing. (See Figure 15.) The typical pattern of use is this: participants log-in rapidly, obtain a list of pending messages, make responses where appropriate, and log out. There is no lingering for the exchange of chit-chat, and exchanges tend to be businesslike. In Sweden, the average FORUM session has been about 7 minutes in duration.

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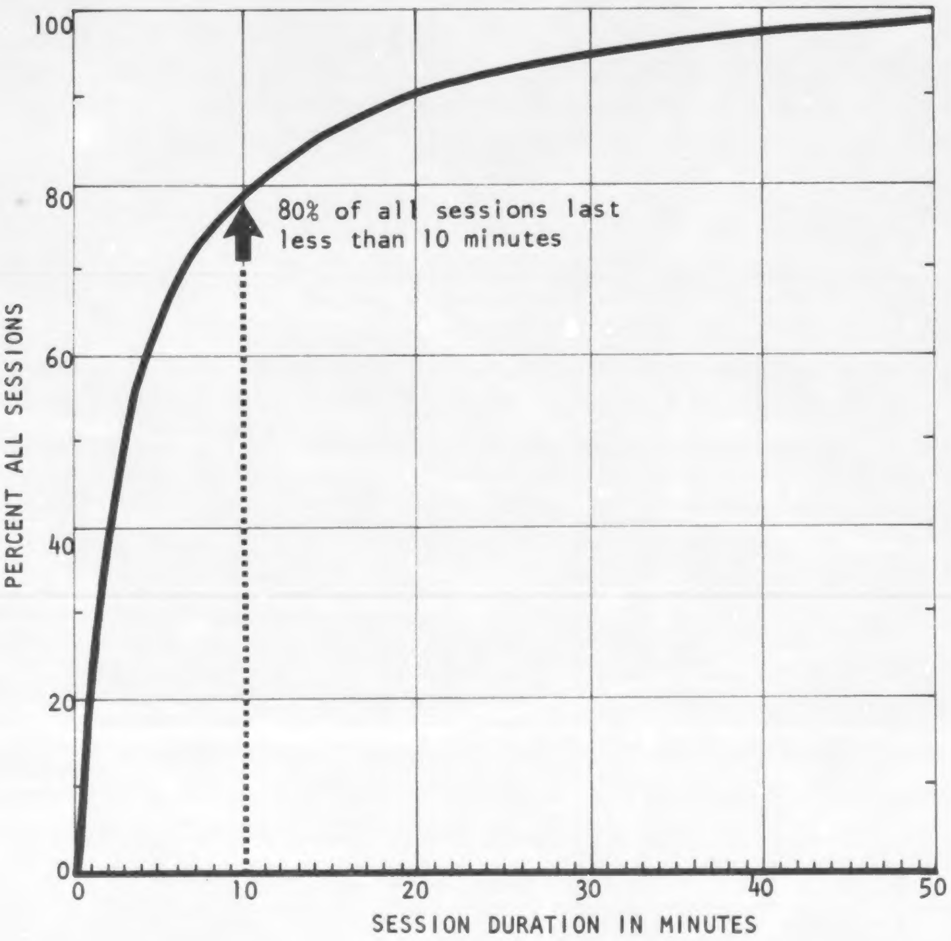
*Murray Turoff, "The Costs and Revenues of Computerized Conferencing," *Proceedings of the Third International Conference on Computer Communication,* August 1976.

**D. W. Conrath, "The Computer as an Interpersonal Communication Device: A Study of Augmentation Technology," *Proceedings of ICCC '74,* Stockholm, p. 121.

FIGURE 15

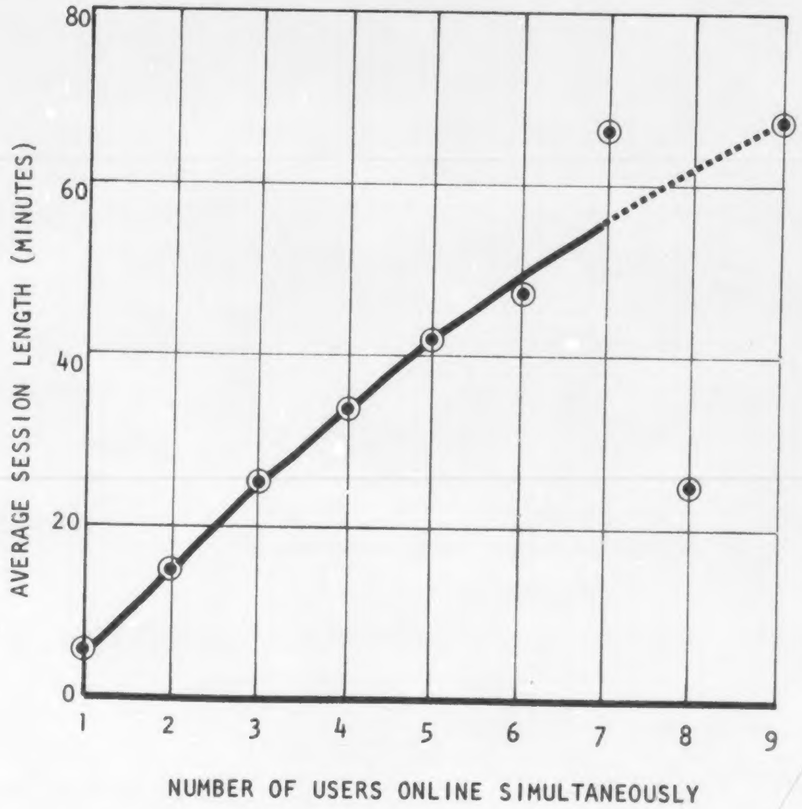
DISTRIBUTION OF SESSION LENGTH



Session duration is, however, dependent on the number of people on-line simultaneously. Not surprisingly, the more people who join an activity, the longer the session lasts (see Figure 16).

FIGURE 16

EFFECT OF GROUP SIZE ON SESSION DURATION



The frequency of sessions* is indicated by Figure 17. This figure shows the average time between log-ins throughout the day. During peak usage, the time between sessions is 5 minutes; at the other extreme, there are 110 minutes between sessions from 8:00 p.m. to 4:00 a.m.

If interpreted too strictly, these aggregate findings for frequency and length of sessions could be misleading. In fact, we find that 10 percent of the users account for more than half of all sessions; 50 percent of the users account for 95 percent of all sessions (Figure 18). Thus, half of the participants in this study used the medium much less frequently and for shorter periods than summary statistics indicate.

There has also been considerable speculation about the effects of computer conferencing on the working day. Figure 19A displays the overall distribution of sessions as a function of local time of the participant. The distribution suggests that, while those who have easy access to terminals may use them at home or outside of normal working hours, the great majority of sessions occur during the typical business day. The peak usage period is at the beginning of the day, with a secondary peak in the afternoon. One participant in a NASA conference explained his preference for this pattern:

> [154] Whorf 13-Nov-75 1:11 PM
> One of the features that I particularly like is that of being able to come in the first thing in the morning and get updated. Also late in the afternoon, I can check on what has transpired during the day.

The Swedish data, however, suggest a different kind of usage. The workday in Stockholm begins sharply at 8:00 a.m., but people tend to use the computer over lunch time and in the evening, producing the pattern shown in Figure 19B. Still, neither the Swedish data nor our 18-month results indicate a significant change in the workday.

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*"Session" denotes the participation of an individual within a PLANET/FORUM activity. It may turn out, however, that individuals enter a number of activities while they are logged into the computer (through the use of the JOIN command). On the average, there are 1.4 sessions per log-in.

FIGURE 17

AVERAGE TIME BETWEEN SESSIONS THROUGHOUT THE DAY

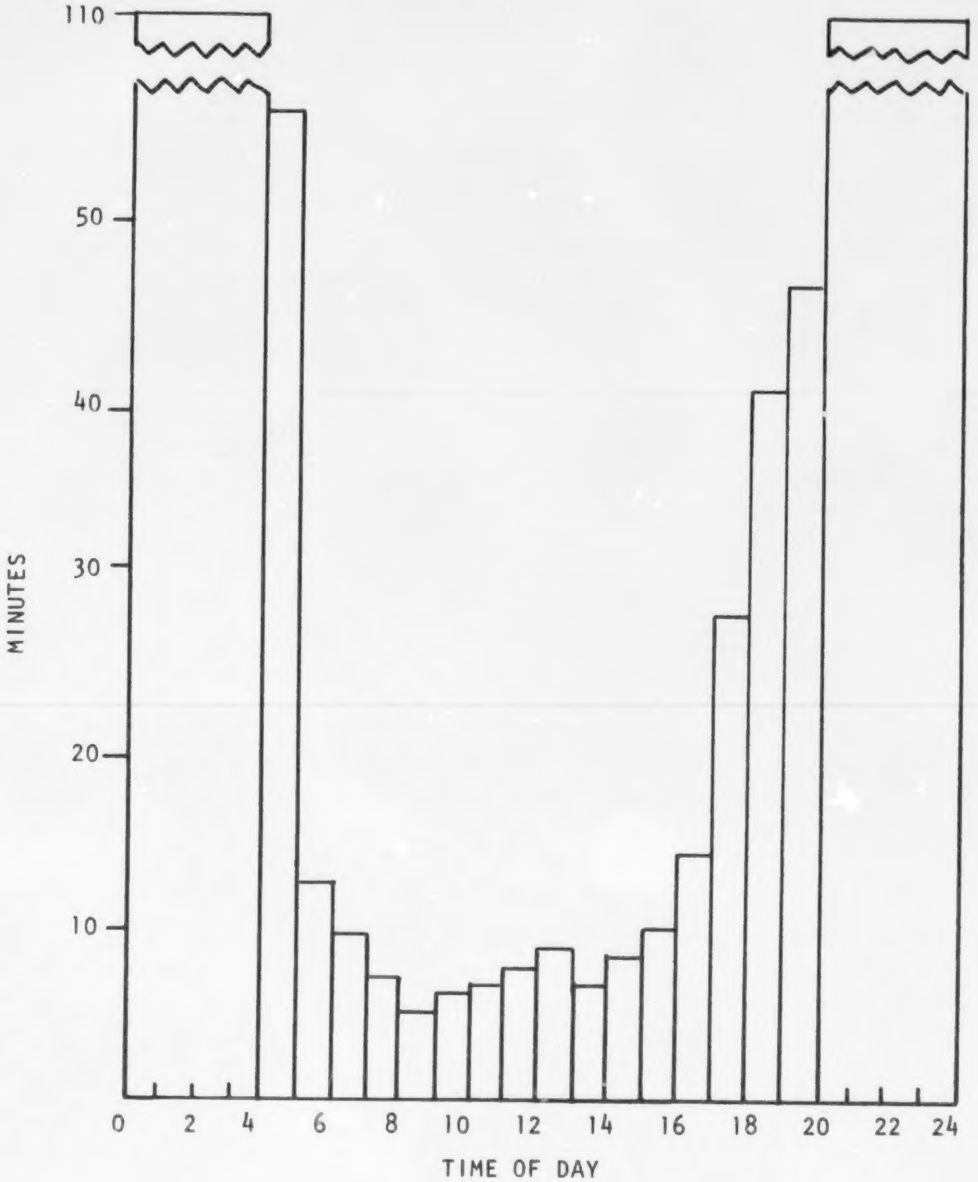
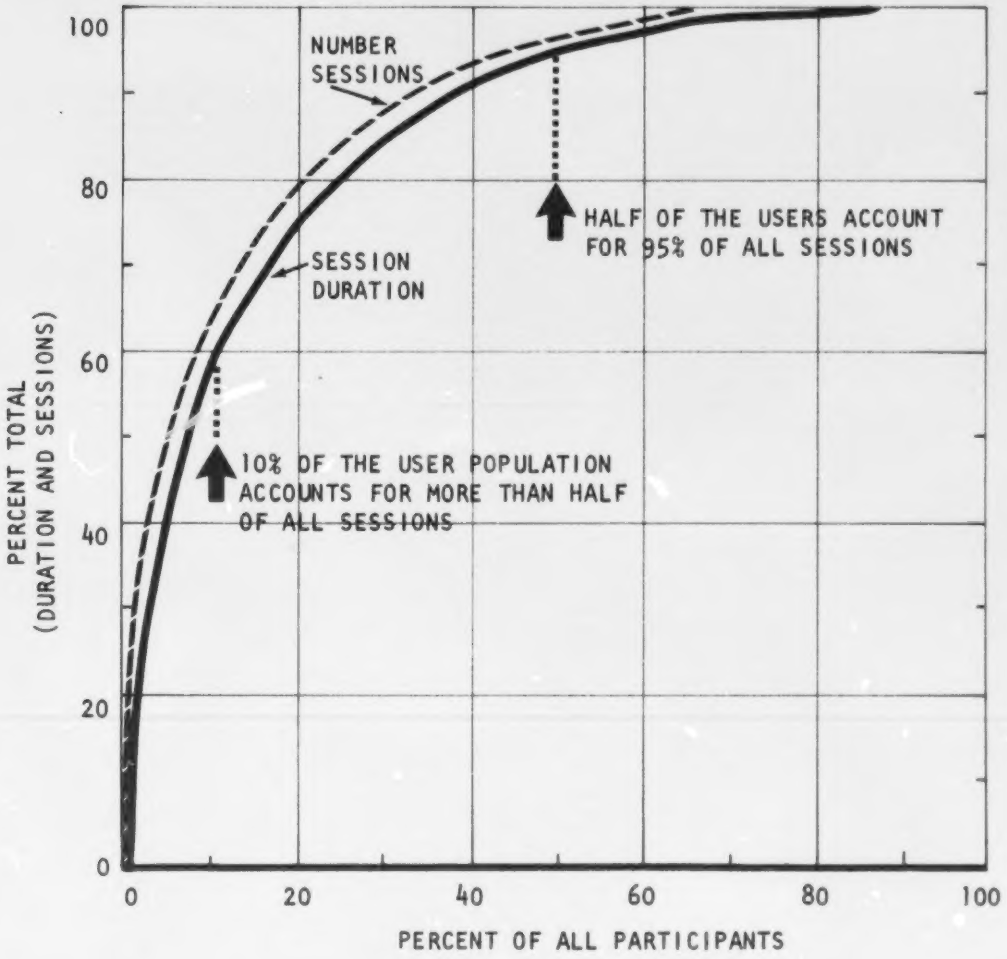


FIGURE 18

DISTRIBUTION OF SESSIONS OVER THE USER POPULATION

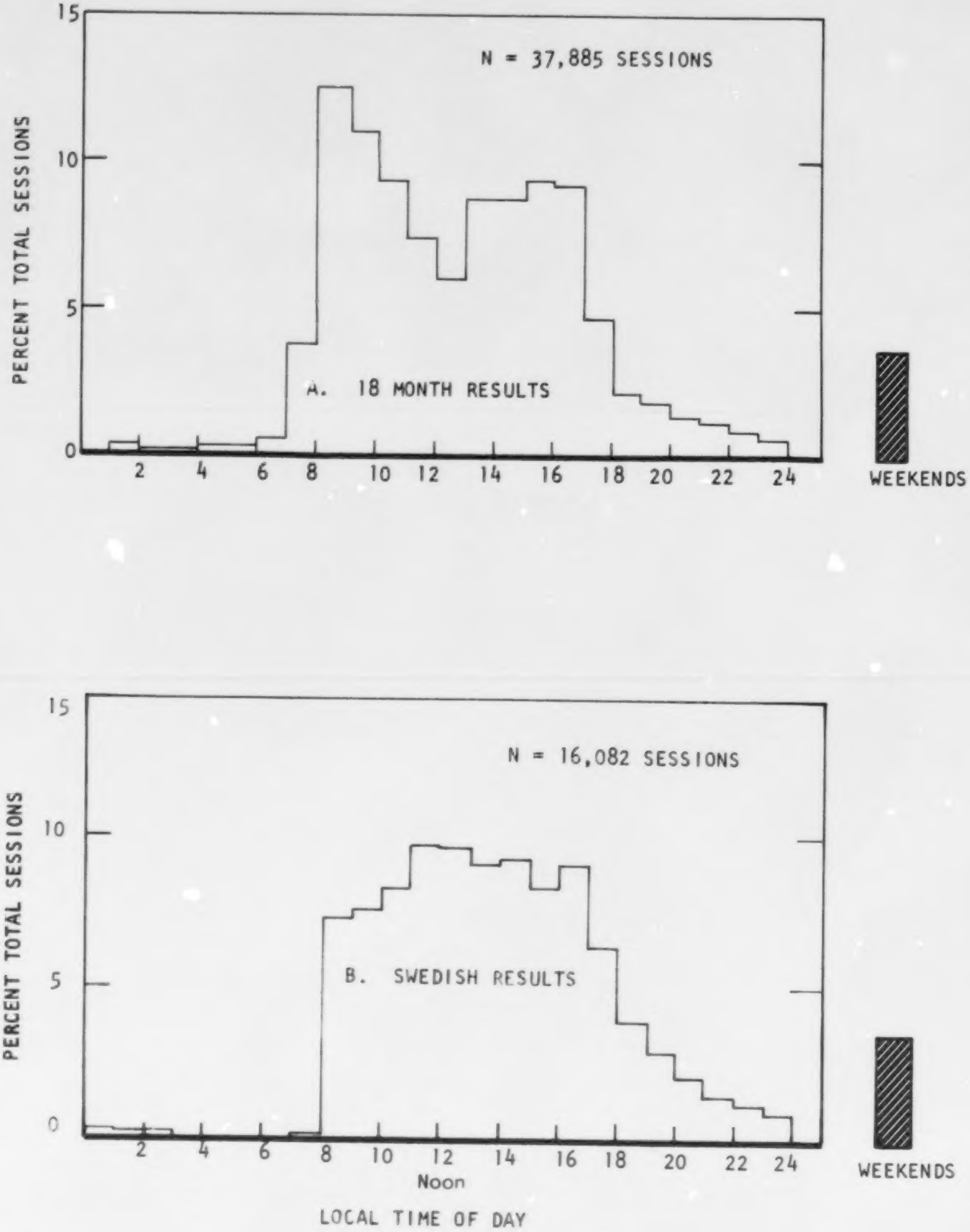


Graph based on:

37,909 sessions
4,687 hours of use
484 users

FIGURE 19

DISTRIBUTION OF SESSIONS AS
A FUNCTION OF LOCAL TIME OF DAY



EVOLUTION OF ORGANIZATIONAL STYLES

Most of the existing literature on teleconferencing is either projection and speculation or the result of brief experiments, usually with one-time users. Yet it is not reasonable to assume that real use over an extended period will produce the same patterns as experimental applications in the lab. As one of our users, Professor Estrin of UCLA, remarked during one PLANET workshop, "We cannot assume that patterns of usage [for PLANET] will be stable within an organization until several months have passed, and even for long-term users, there may be some phenomena that only take place after one year, two years, or longer."

With these cautionary remarks in mind, we have analyzed usage patterns for the USGS, NASA, and the Institute for the Future over 18 months; we have done the same for Kettering, NLM, and ERDA, who used PLANET over a shorter period. This analysis reveals the following organizational differences:

- Public messages per hour (Figure 20). Public message-sending rates vary widely in the early months of an organization's use of the medium. Over a period of six months, they converge toward a value which represents an "average" for a particular organization, but which may differ from that of other organizations. Typical "end values" were 7 public messages per hour for IFTF, 6 for Kettering, and 3.5 for NASA and USGS.
- Private messages per hour (Figure 21). The private message-sending rate dropped continuously for all organizations except Kettering. At IFTF, the value went from above 6 to below 4 messages per hour over an 18-month period. Similar decreases were seen at NASA and USGS; at the end of our study, the rate seemed to be stabilizing between 4 and 5 messages per user hour for the four organizations with the longest exposure to the emdium. NLM forbade the use of private messages and thus has a very low private message rate.

FIGURE 20

ORGANIZATIONAL PATTERNS IN PUBLIC MESSAGE-SENDING RATES

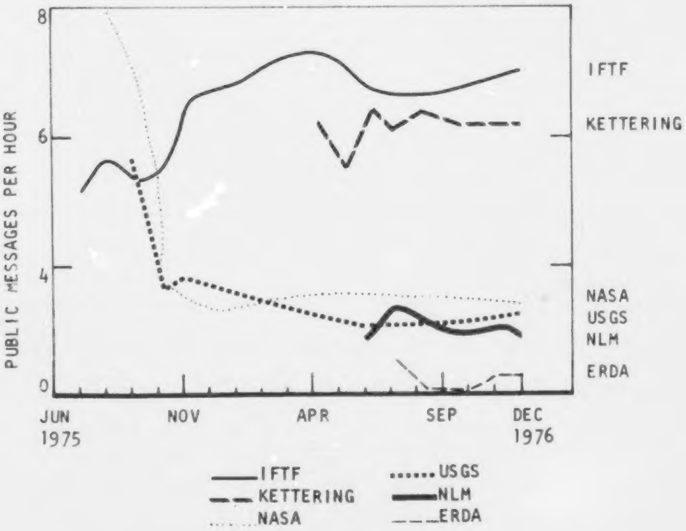
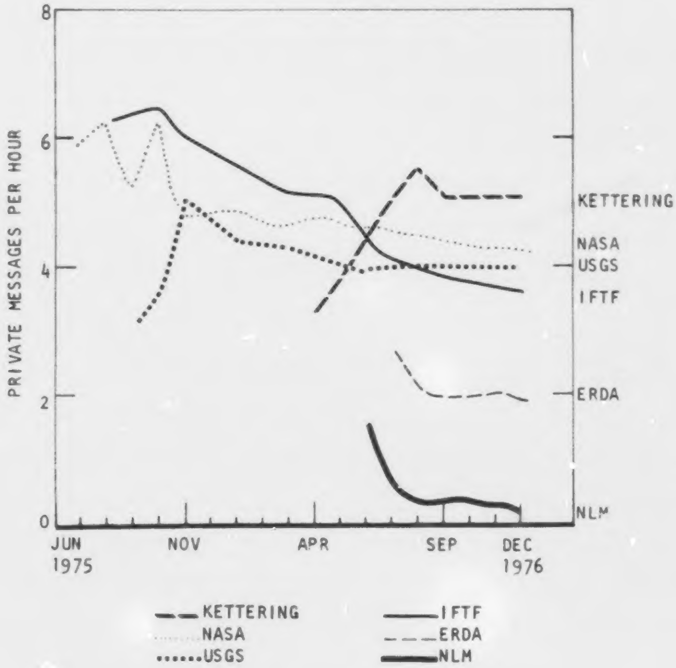


FIGURE 21

ORGANIZATIONAL PATTERNS IN PRIVATE MESSAGE-SENDING RATES



ERDA, too, has a lower rate of private message exchange, though these data represent a relatively short exposure to the medium; possible explanations are less concern about connect time and slower response time for PLANET-2.

- Public verbosity (Figure 22). The findings for public and private message-sending rates could mean several things. During a given session, a participant has to read messages from others to get up to date. If the conference is very busy, the user may have less time for private messages. On the other hand, we might just find that the message rate stabilizes, but messages get longer. To check that possibility, we watched the evolution of public verbosity and found that there is usually an initial increase in verbosity which stabilizes at a value remarkably consistent across organizations. The average message length is between 60 and 70 words. The only exception is NLM, with a very large increase in public verbosity after the organizer decided to forbid private messages.
- Use of editing characters (Figure 23). We have examined the use of editing characters to detect any "group learning" effects. The results are inconclusive. Some groups (IFTF, NLM) showed declining use of editing characters as time went on. Others (USGS, ERDA) showed an increase. NASA and Kettering were remarkably consistent. Values at the end of the period ranged from 15 to 25 edits per hour for the six organizations we were tracking.
- Use of commands (Figure 24). In contrast to editing characters, commands were used uniformly by these groups, with end values of 12 to 14 commands per hour. Kettering is the exception in this case, with a consistent value of 7.5 commands per hour. This exception can probably be explained by the fact that most Kettering participants were attending only one conference at a time; thus, they did not need to use the JOIN command, which is one of the most heavily used. We conclude from these observations that group learning of command usage is rapid and stable compared to other behavioral parameters. Some groups use editing twice as much as others, but they behave similarly in the use of commands.

FIGURE 22

ORGANIZATIONAL PATTERNS IN PUBLIC VERBOSITY

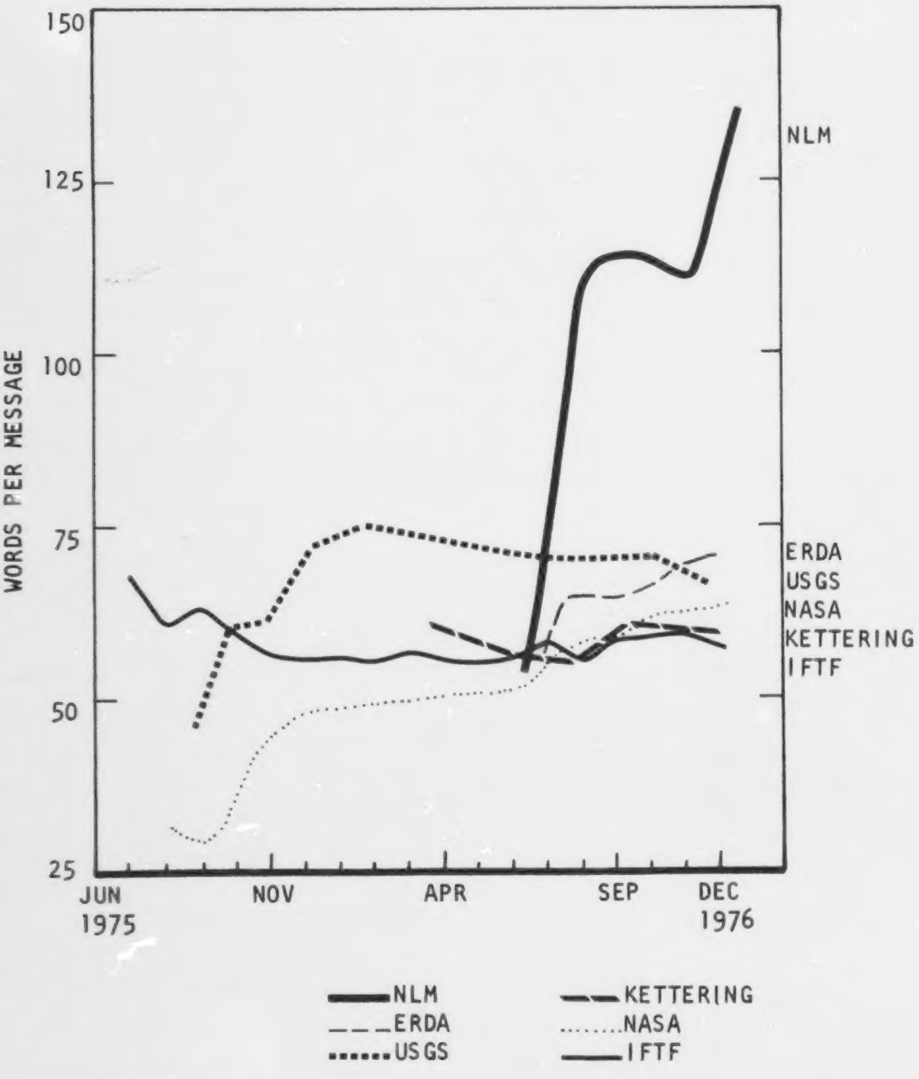


FIGURE 23

ORGANIZATIONAL PATTERNS IN THE USE OF EDITING CHARACTERS

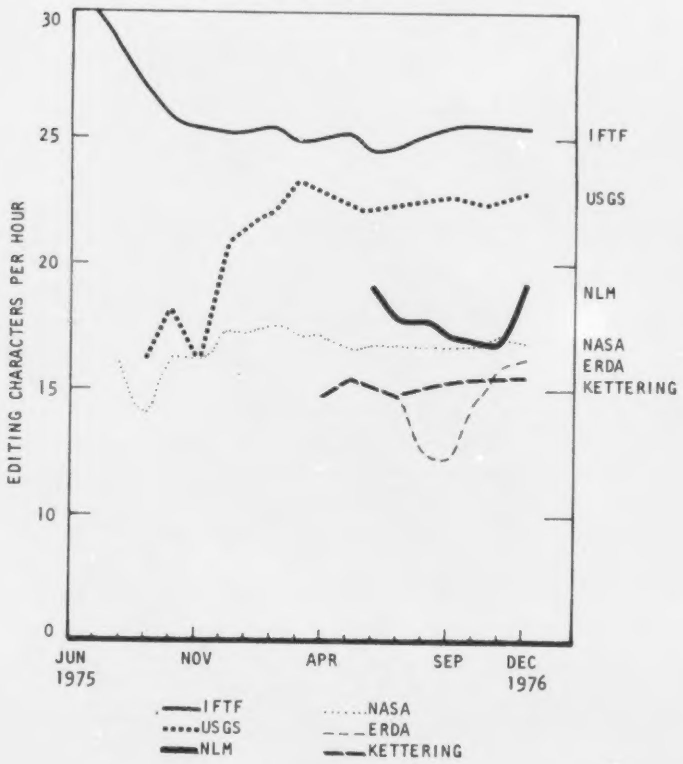
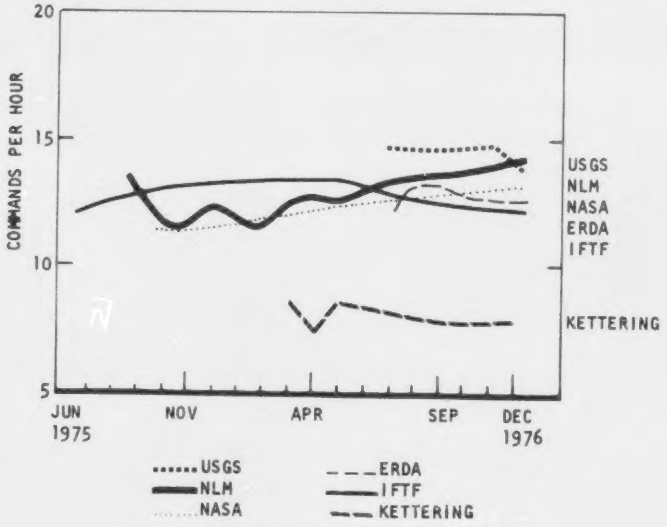


FIGURE 24

ORGANIZATIONAL PATTERNS IN THE USE OF COMMANDS



- Average session duration (Figure 25). We have observed an average session duration ranging from 6 to 12 minutes across groups. For some organizations (NASA, ERDA, and USGS), duration has declined during the study. For others, it has remained even or has increased. We believe this pattern to be related to the purpose of the conferences. The three organizations that evolved toward shorter sessions were composed of technologists (scientists and engineers) who developed a highly cost-effective way of using the medium in the management of long-term projects. Other organizations were applying the system to the discussion of conceptual rather than technical issues, and no optimization of their work style was possible on the basis of shorter sessions alone. Thus, we feel that the pattern of decreasing session duration is probably typical of the "notepad" style; the "seminar" or "assembly" styles of teleconferencing are more likely to have even or increasing durations.

- Ratio of private to public messages (Figure 26). The percentage of messages that are private show considerable fluctuations, although after a few months, cumulative values tend to cluster within a fairly small range (35 percent to 55 percent). It is interesting to note that IFTF has become increasingly "public" in its own use of PLANET, perhaps because the novelty of private messages wore off with time. The low value at NLM is due to the organizer's decision to overtly discourage private messages. The consistency of the patterns observed for NASA and USGS is remarkable.

- Time spent typing (Figure 27). The amount of time spent typing during an average session shows no striking pattern and exhibits no "group learning." Typing time is less than 50 percent of session duration and remains fairly constant for each organization.

- Percent of time spent outside working hours (Figure 28). Many of the projections for computer conferencing reflect enthusiasm for the positive social impacts the medium might have. It is argued that people will increasingly "attend" conferences from their homes and will take advantage of the time flexibility afforded by the system. These possibilities are indeed present in a system

FIGURE 25

ORGANIZATIONAL PATTERNS IN SESSION DURATION

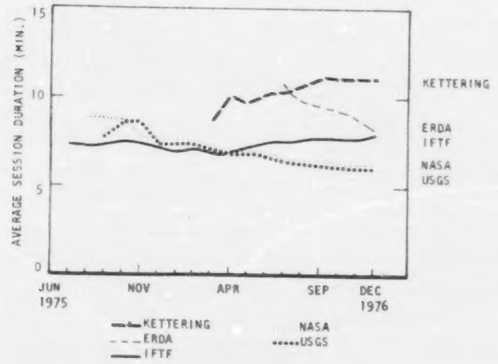


FIGURE 26

ORGANIZATIONAL PATTERNS IN THE RATIO OF PRIVATE TO PUBLIC MESSAGES

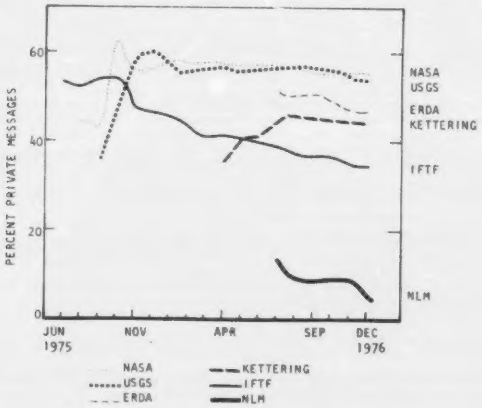


FIGURE 27

ORGANIZATIONAL PATTERNS IN TIME SPENT TYPING

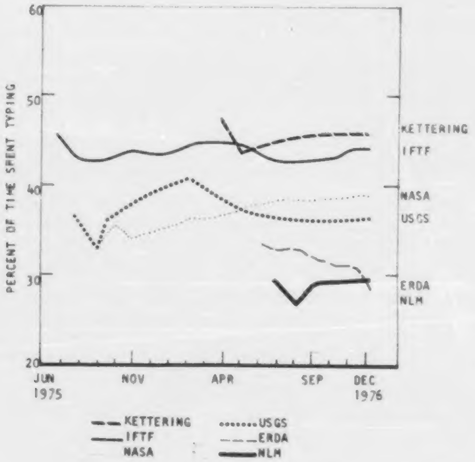
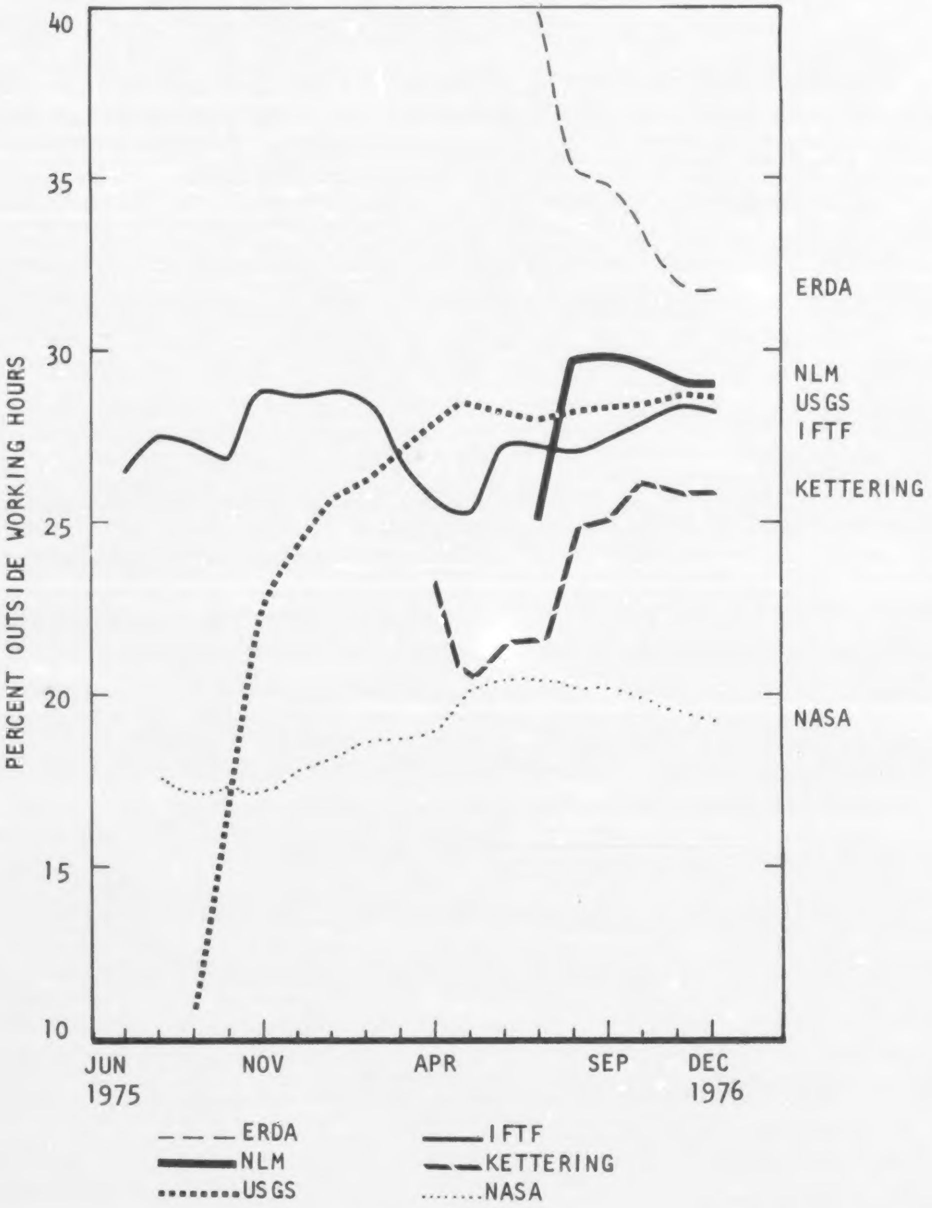


FIGURE 28

ORGANIZATIONAL PATTERNS IN TIME SPENT OUTSIDE WORKING HOURS



like FORUM/PLANET, and we have had occasion to observe them in many specific cases. We have even reported some changes in the use of the workday by our group, with high evening and weekend usage.* When we take a longer-term view of this situation, however, we find that organizations differ in their adaptation of computer conferencing to the office world. Some, like the USGS, exhibit a rising fraction of usage outside of office hours. At NASA, the percentage peaked at about 20 percent after 12 months of usage; then it decreased again. At ERDA, the percentage has tended to decrease, although detailed patterns will have to be examined in the group-by-group analysis we are performing for another project.**

On the basis of our data, it seems that it would be reasonable to expect 25 percent (±5 percent) of usage to take place outside of office hours, defined as 8:00 to 12:00 and 1:00 to 5:00. Yet it is difficult to conclude that this represents genuine changes in working patterns of the user population. It may mean that users postpone their lunch or stay briefly after work to take advantage of less-loaded computers. When computers become more reliable and more accessible, this apparent flexibility may vanish.

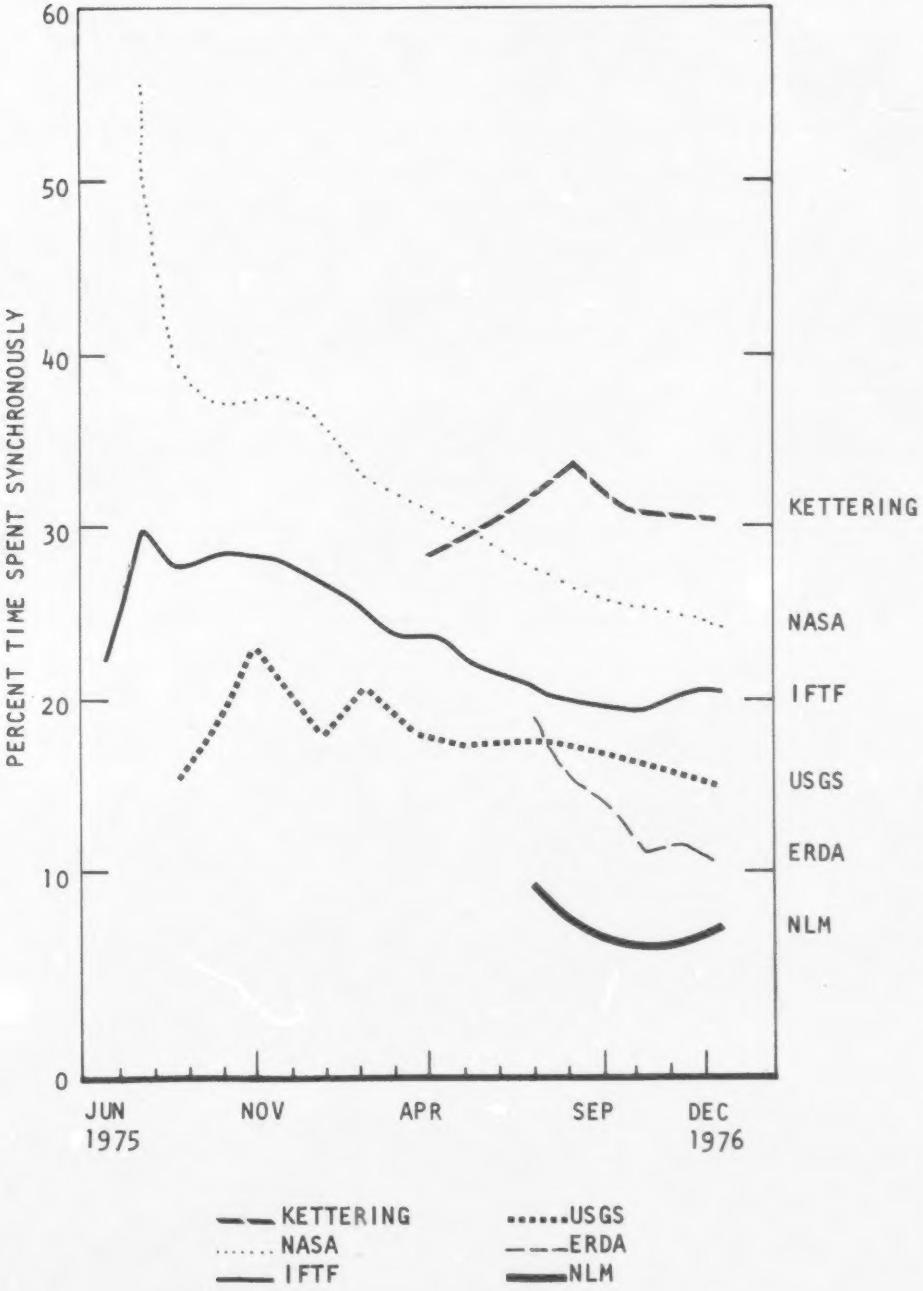
- Percent of time spent synchronously (Figure 29). In looking at organizational use of the medium over time, we find a marked trend away from synchronous meetings, perhaps because users find them time-consuming and expensive or because they do not derive enough substantive benefits from them or because the discipline to use them effectively has not yet evolved. Also, differences in time zones may inhibit synchronous usage. This is clearly a point where much speculation can be expected in years to come. Generally speaking, the fraction of time spent synchronously has decreased, sometimes very rapidly (NASA), sometimes slowly (USGS). At Kettering, it has remained above 30 percent. For others, 20 percent is more typical.

***Group Communication Through Computers, Volume 3*, Proposition 13, pp. 134-5.

***Group Communication Through Computers, Volume 5: Effects on Working Patterns*, forthcoming.

FIGURE 29

ORGANIZATIONAL PATTERNS IN TIME SPENT SYNCHRONOUSLY



NOTE: During the fall of 1975, two participants in the Future of Transportation Conference limited their message sending to private synchronous exchanges. When this conference ended, NASA's "style" changed significantly.

> Such a long-term trend might again reverse itself if the user population became really large (400 users a day, for instance) and if the cost of conferences decreased to less than $10 per hour. However, we feel that the patterns here are social rather than purely economic. Advocates of electronic mail could also use this finding to support the view that synchronous conferencing is an unnecessary frill and that our users are slowly "rediscovering" point-to-point communication. Others may prefer to argue that synchronous meetings are truly an "altered state" of communication and that the psychological and social structures for its use have not yet evolved in the environments we have observed. The fact remains that it would seem unreasonable to project synchronous use to be more than 25 percent of all use in current work situations.

While it is possible to identify a variety of possible "causes" for the differences in styles noted here, it seems likely that four variables play an important role in determining the way in which organizations use computer conferencing. These include: (1) access to terminals, (2) training, (3) facilitation, and (4) management choices (such as NLM's decision to forbid private messages).

COMPARING MEDIA

One of the objectives of our continuing work in computer conferencing has been to relate the interaction patterns in PLANET conferences to audio or face-to-face interaction. We have attempted, whenever possible, to apply the same techniques of measurement and monitoring to quantify observable interactions in these media. We have paid special attention to the frequency and length of messages and to participation rates. We have also tried to characterize individual participation patterns for users who could be observed in different communications situations.

In the field study approach taken here, it has not been practical for us to organize controlled experiments or even to observe a series of meetings with an identical group of people. However, we did monitor six conferences involving the U.S. Geological Survey and NASA. Three of these conferences were held via computer conferencing, two via audio, and one face to face. Although it would be dangerous to draw general conclusions from these limited observations, the method used can help to clarify the characteristics of computer conferencing compared to other media.

The method relies on a graphic presentation of the use of time during a meeting. This graph shows the percentage of entries made by each group member, compared to the percentage of meeting time taken by that person. Each quadrant of this graph may be viewed as a different type of behavior; we have labeled these different types as follows: (1) the *leaders*, who have a high percentage of all messages and take a high percentage of the total meeting time; (2) the *supporters*, who have a low percentage of both messages and time; (3) the *reporters*, who take a high percentage of the time but have relatively few messages; and (4) the *hecklers*, who have lots of very short messages, using only a small percentage of the time. Such a graph, which can be plotted for any medium, provides a technique for analyzing changes individual patterns from medium to medium. However, we have only used it in a limited way, and we are presenting the following comparison only as an illustration of a possible avenue of research.

Case 1: The UNESCO Conference on Mineral Resource Data Bases (Face-to-Face)

This conference took place at the UNESCO building in Paris on November 28, 1975. The subject was a discussion of an international geological project; it focused on an initial review of a Canadian document on data-base standards for the international exchange of mineral resource information. There were 21 people in the room. We timed the participants' comments from 11:25 a.m. to 12:07 p.m., when the group went to lunch. The chronology of the discussion was recorded, along with a summary of each comment. The 10 participants who made statements during the observation period are listed in Table 3, together with the number of statements ("entries") by each participant, their duration, and the percentage of the total messages and time for each person.*

Using these statistics, we plotted the graph in Figure 30. We note that Clark and Hutchison, the two most dominant participants, account for 55 percent of the total conference time.

Case 2: A NASA Audio Conference

This audio conference was held on 17 December 1975. The audio teleconferencing facilities of NASA were used by the 11 people from 8:30 a.m. to 1:00 p.m., Pacific Standard Time. Thad Wilson attended the meeting and recorded the entire session on tape. This recording was transcribed and provides the data for this analysis. In order to analyze the conference, two samples were selected from the transcript in the following manner:

> The conference was divided into nine sections of approximately 30 minutes each. Those sections that were nonsubstantive or atypical in

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*We have used the following conversion system in comparing the three media: 1 word = 5 characters; average typing speed = 20 words per minute; average speaking rate = 135 words per minute; and 1 typed line = 12 words = 36 seconds. In all cases, participant statistics have been converted to give a percentage of total time for each user.

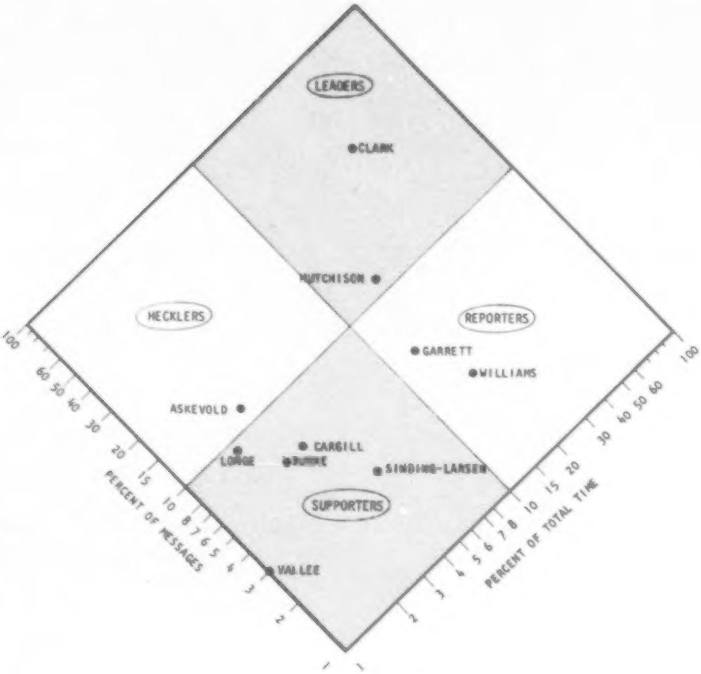
Case 1

TABLE 3. PARTICIPATION DATA FOR CASE 1

	Number of Entries	Length in Seconds	% of All Entries	% of Total Time
CLARK	12	920	35.2%	37.5%
BURK	2	62	5.8	2.5
CARGILL	2	80	5.8	3.2
VALLEE	1	5	2.9	.02
ASKEVOLD	4	65	11.7	2.5
LONGE	3	45	8.8	1.8
SINDING-LARSEN	3	105	8.8	4.2
GARRETT	2	300	5.8	12.2
HUTCHISON	4	432	11.7	17.6
WILLIAMS	1	435	2.9	17.7
	34	2,449	100.0%	100.0%

FIGURE 30

USE OF TIME IN THE UNESCO FACE-TO-FACE CONFERENCE



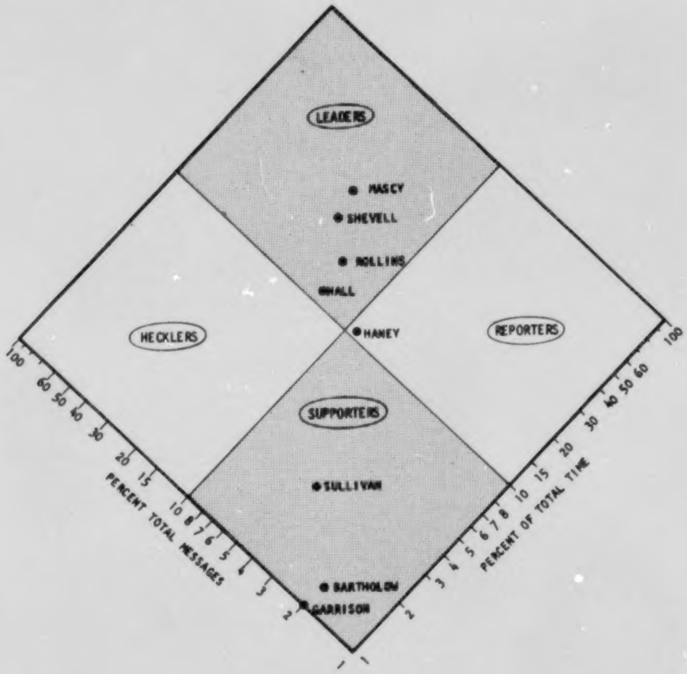
Case 2

TABLE 4. PARTICIPATION DATA FOR CASE 2

Participant	Number of Entries	Number of Words	% of All Entries	% of Total Time
MASCY	24	1,281	25.0	31.5
ROLLINS	16	686	16.7	16.9
SHEVELL	22	951	22.9	23.4
HALL	15	480	15.6	11.8
HANEY	9	454	9.4	11.2
BARTHOLOW	2	55	2.1	1.4
GARRISON	2	16	2.1	0.4
GELLMAN	2	21	2.1	0.5
SULLIVAN	4	117	4.1	2.9
TOTAL	96	4,061	100.0	100.0

FIGURE 31

USE OF TIME IN A NASA AUDIO CONFERENCE



some way were eliminated. Next, two samples of 15 minutes each were chosen from the remaining sections: Sample 1 came from the section which had the highest degree of interaction, with 37 messages. Sample 2 was drawn from the section following a coffee break. It was during these two sections that much of the substantive discussion of the conference took place. Finally, the two samples were analyzed in the same way as in the public transcript of the computer conference.

The results of the analysis are shown in Table 4. The information exchange rate here is 135 words per minute (assuming 1 word = 5 characters), and the average length of a message is 212 characters. Again, we are able to plot participant positions, based on their percent of total time talking and their percent of total messages (Figure 31).

Case 3: A USGS Audio Conference

Case 3 is an audio conference which took place on June 8, 1973, in connection with some of the earliest uses of FORUM at the USGS. It involved people at three sites: Allen Clark, Joe Botbol, and Roger Bowen in Washington, DC; Jacques Vallee, Rich Miller, and Hubert Lipinski at the Institute for the Future in Menlo Park; and Gerald Askevold and Travis Hudson at the Survey in Menlo Park. Table 5 summarizes the participation data from a transcribed tape of the conference. From these data, we derive the participation patterns shown in Figure 32. We note that the two most dominant participants (Botbol and Miller) account for 53 percent of total conference time. Clark and Askevold, in contrast to Case 1, are now in the positions of reporter and heckler, respectively.

Case 4: An Asynchronous Computer Conference at the USGS

Case 4 was an international conference which followed the COGEODATA meetings in Paris, in December 1975. Total participation in terms of time online and number of public entries for the period November 17, 1975, to January 1[illegible], 1976, is shown in Table 6. Figure 33 shows individual participation rates in terms of total entries and total time. In this conference,

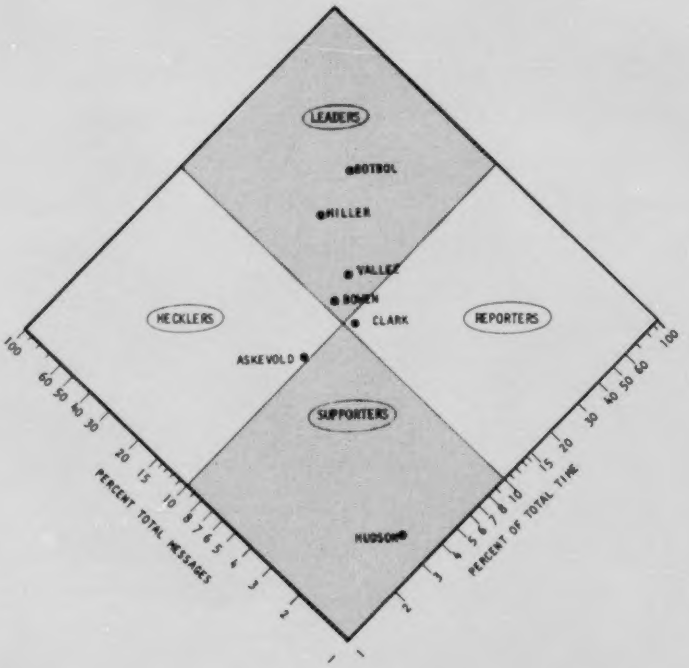
Case 3

TABLE 5. PARTICIPATION DATA FOR CASE 3

Participant	Number of Entries	Words	% of All Entries	% of Total Time
MILLER	36	1,087	26.0	19.6
BOTBOL	37	1,842	27.0	33.3
VALLEE	18	832	13.0	15.0
BOWEN	17	602	12.4	10.8
CLARK	12	624	8.7	11.2
ASKEVOLD	14	333	10.2	6.0
LIPINSKI	1	15	---	0.2
HUDSON	2	186	1.4	3.3
	137	5,523	100.0%	100.0%

FIGURE 32

USE OF TIME IN A USGS AUDIO CONFERENCE



Case 4

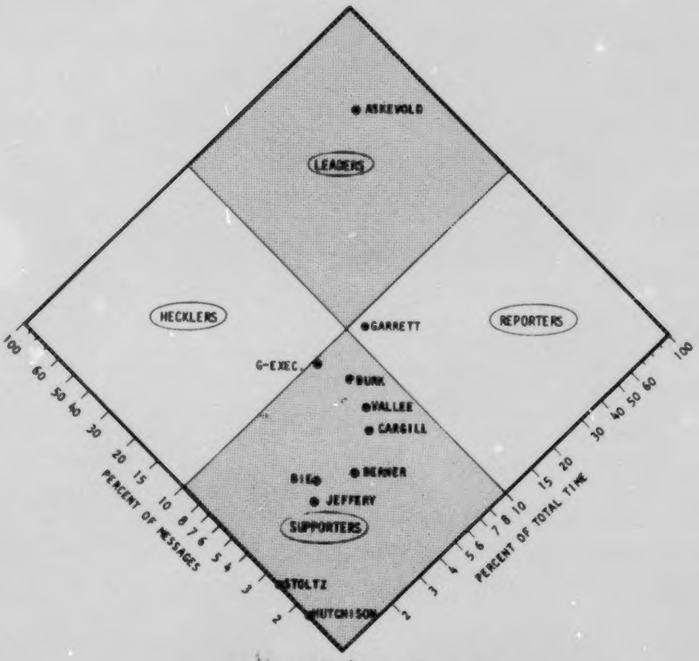
TABLE 6. PARTICIPATION DATA FOR CASE 4

Participant	Number of Entries*	Typing Time in Seconds	% of All Entries	% of Total Time
ASKEVOLD	56	15,528	45.5	49.7
CLARK	0	---	---	---
YOUNT	1	97	0.8	0.3
VALLEE	7	2,106	5.7	6.7
WILSON	0	---	---	---
BOWEN	2	90	0.8	0.3
CARGILL	5	1,829	4.1	5.9
STOLTZ	3	306	2.4	1.0
BURK	8	2,300	6.5	7.4
GARRETT	11	3,521	8.9	11.3
HUTCHISON	2	245	1.6	0.8
BRIGHT	1	90	0.8	0.3
TRACY	1	216	0.8	0.7
BERTOUX	1	72	0.8	0.2
BIE	5	850	4.1	2.7
JEFFERY	4	764	3.3	2.4
KLEIN	1	47	0.8	0.2
PLATO & BERNER	4	1,199	3.3	3.8
WHEELER (G-EXEC)	12	1,980	9.8	6.3
	123	31,240	100.0%	100.0%

*Public entries only. Private and non-substantive entries have been excluded.

FIGURE 33

USE OF TIME IN A USGS ASYNCHRONOUS COMPUTER CONFERENCE



the two dominant participants (Askevold and Garrett) account for 61 percent of total conference time. Some of the leaders of earlier meetings (Clark and Botbol) did not participate.

Case 5: A Synchronous Computer Conference at USGS

On February 5, 1976, nine participants in the international geological conference "met" for over two hours.* These nine participants represented four nations. Their participation data are shown in Table 7; again, these data can be plotted to show individual use of time in the conference (Figure 34).

Case 6: A Synchronous Computer Conference at NASA

This final comparison case is a synchronous computer conference which was held on 19 November 1975 and linked 10 persons from eight organizations for two hours. Using the statistics shown in Table 8, we plotted individual participation in terms of the percent of total time typing and percent of total messages (Figure 35).

---

*It is noteworthy that the total cost of this two-hour conference linking four countries was $250. Average cost per message was $1.75, and average cost per 20 words was 64 cents. (By contrast, the cost of a telegram to Trondheim, Norway, would have been $5.30 for 20 words.)

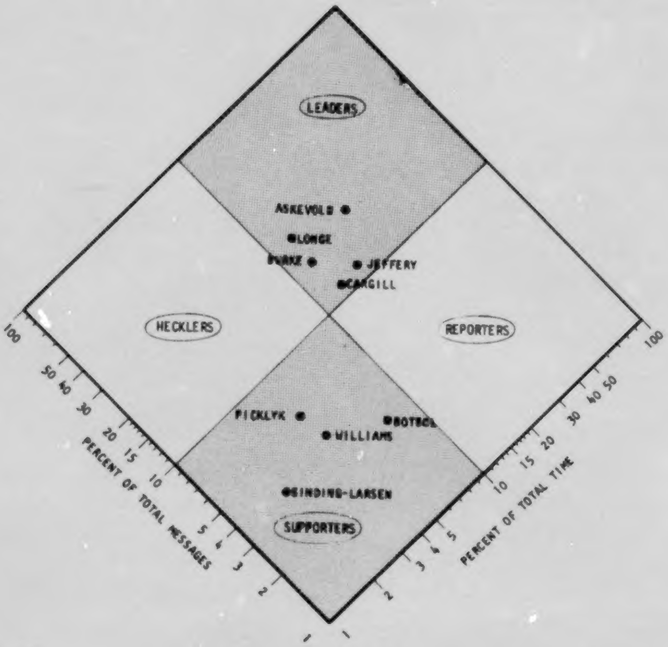
Case 5

TABLE 7. PARTICIPATION DATA FOR CASE 5

Participant	Number of Entries	Number of Words	% of Total Entries	% of Total Time
ASKEVOLD	28	1,968	19.5	25.2
LONGE	34	1,046	23.8	13.4
PICKLYK	8	297	5.6	3.8
JEFFERY	17	1,315	11.9	16.8
SINDING-LARSEN	5	141	3.5	1.8
CARGILL	17	1,129	11.9	14.3
BOTBOL	4	555	2.8	7.1
WILLIAMS	6	328	4.2	4.2
BURK	24	1,036	16.7	13.3
	143	7,806	100.0	100.0

FIGURE 34

USE OF TIME IN A USGS SYNCHRONOUS COMPUTER CONFERENCE



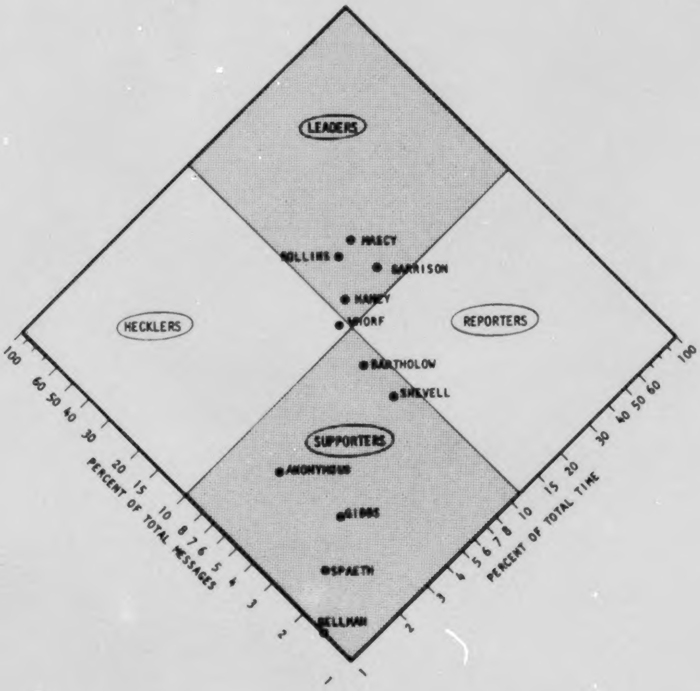
Case 6

TABLE 8. PARTICIPATION DATA FOR CASE 6

Participant	Number of Entries	Number of Words	% of Total Entries	% of Total Time
MASCY	26	927	18.8	18.5
ROLLINS	25	803	18.1	16.0
SHEVELL	7	406	5.1	8.1
WHORF	16	518	11.6	10.3
HANEY	18	597	13.0	11.9
GARRISON	18	991	13.0	19.7
BARTHOLOW	10	448	7.3	8.9
GELLMAN	2	22	1.5	0.4
SPAETH	3	74	2.2	1.5
GIBBS, B.	4	127	2.9	2.5
ANONYMOUS	9	112	6.5	2.2
TOTAL	138	5,025	100.0	100.0

FIGURE 35

USE OF TIME IN A NASA SYNCHRONOUS COMPUTER CONFERENCE



Comparing Cases

We can now compare the information exchange and participation patterns for these six conferences. Consider, for example, the figures illustrating individual use of time in a conference. Both the face-to-face and asynchronous conferences show "speech-giving patterns" with one or two persons dominating the conference. The audio and synchronous computer conferences have much more similar patterns, although audio seems to produce more extreme differences in participation than synchronous computer conferencing. In the latter, several people seem to cluster in the same "leadership" region of the graph.

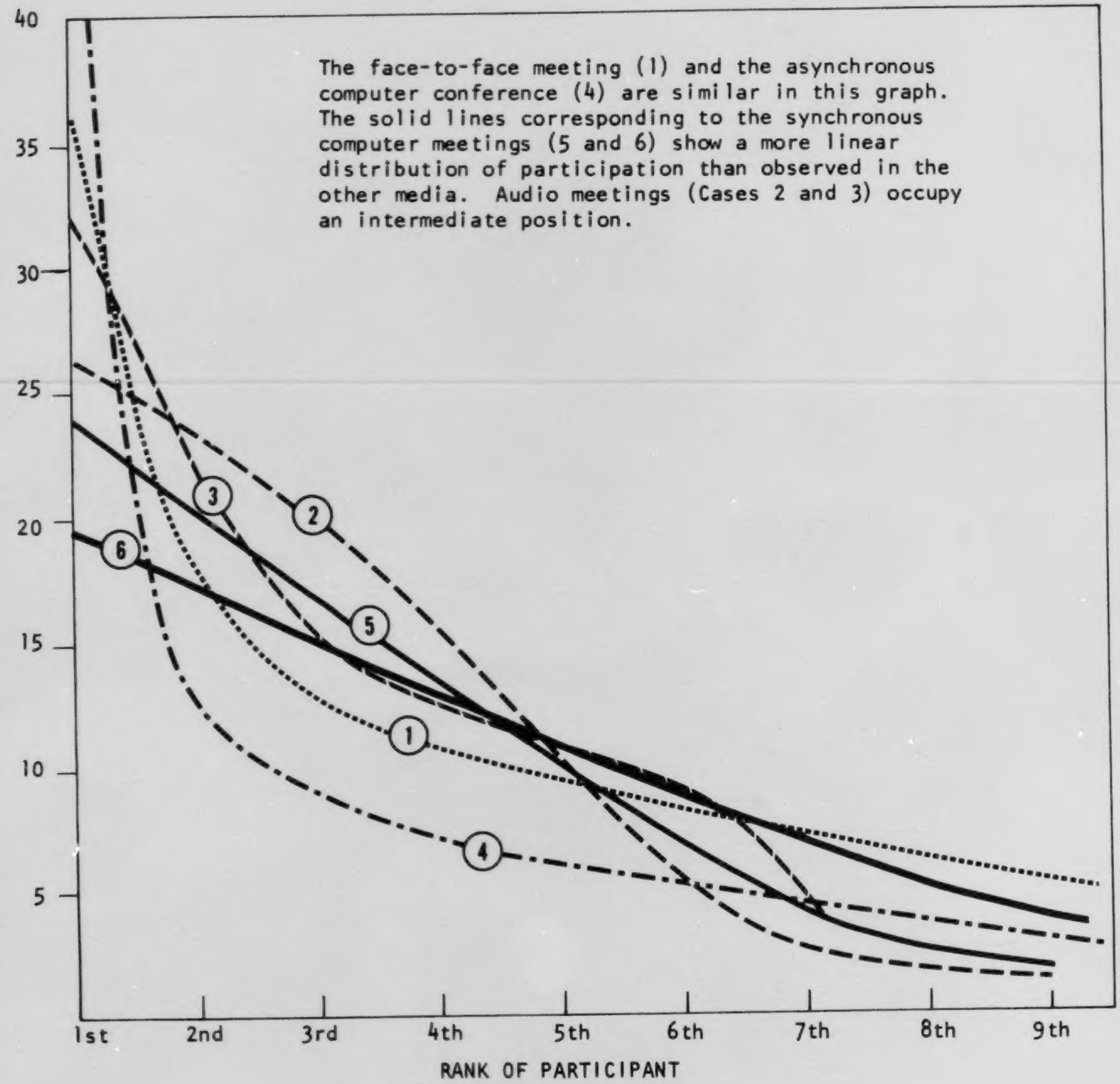
These differences are also illustrated by the participation rankings. We have often noted that participation rates in asynchronous computer conferencing do not differ significantly from those found in face-to-face. Figure 36 verifies this observation: Cases 1 and 4 are similar, showing a typical small group interaction pattern, dominated by a few participants. However, as we have also noted before, synchronous participation rates appear to be more even.

The average frequency and length of messages in the six conferences are shown in Figure 37. The telephone conferences clearly display the fastest interaction. Computer conferencing in the asynchronous mode is slow, while messages are fairly long; in synchronous mode, however, the messages are only half as long and are more frequent than in face-to-face. The longest messages are found in the face-to-face meeting. The distribution of message lengths is shown in Figure 38.

Perhaps the most important observations which can be made using this comparison technique concern the changes in individual patterns of behavior from medium to medium. As we have observed in these six cases, a person who is a leader in one medium may be a supporter in another. It may be that one participant will have a unique grasp of one particular medium, and in meetings via that medium, he or she will dominate the discussion. Such a finding, if substantiated, would have organizational implications: the introduction of a new medium, such as computer conferencing, might change

FIGURE 36

PARTICIPATION RATES IN FOUR CONFERENCES



The face-to-face meeting (1) and the asynchronous computer conference (4) are similar in this graph. The solid lines corresponding to the synchronous computer meetings (5 and 6) show a more linear distribution of participation than observed in the other media. Audio meetings (Cases 2 and 3) occupy an intermediate position.

FIGURE 37

AVERAGE FREQUENCY AND LENGTH OF MESSAGES IN FOUR CONFERENCES USING DIFFERENT MEDIA

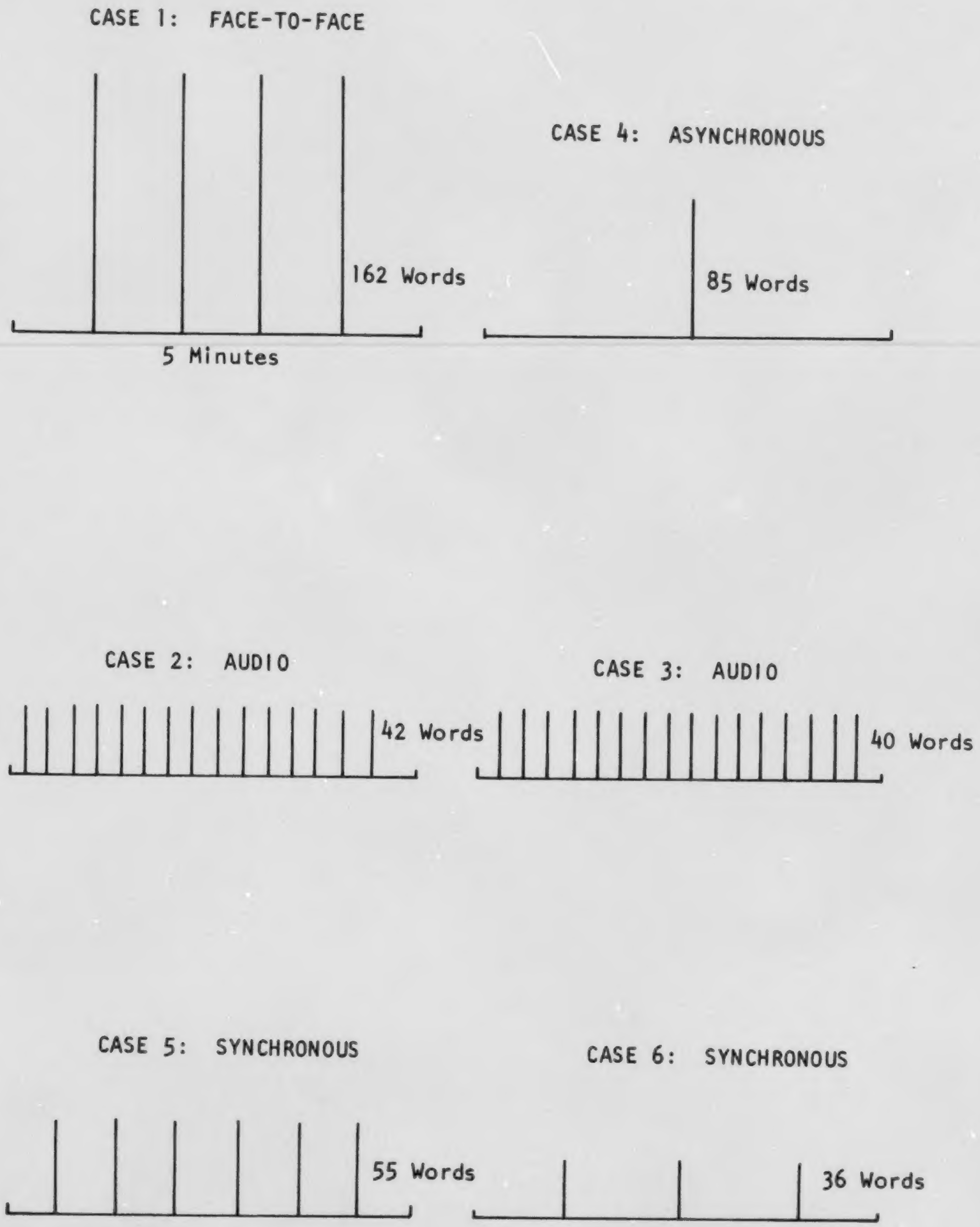
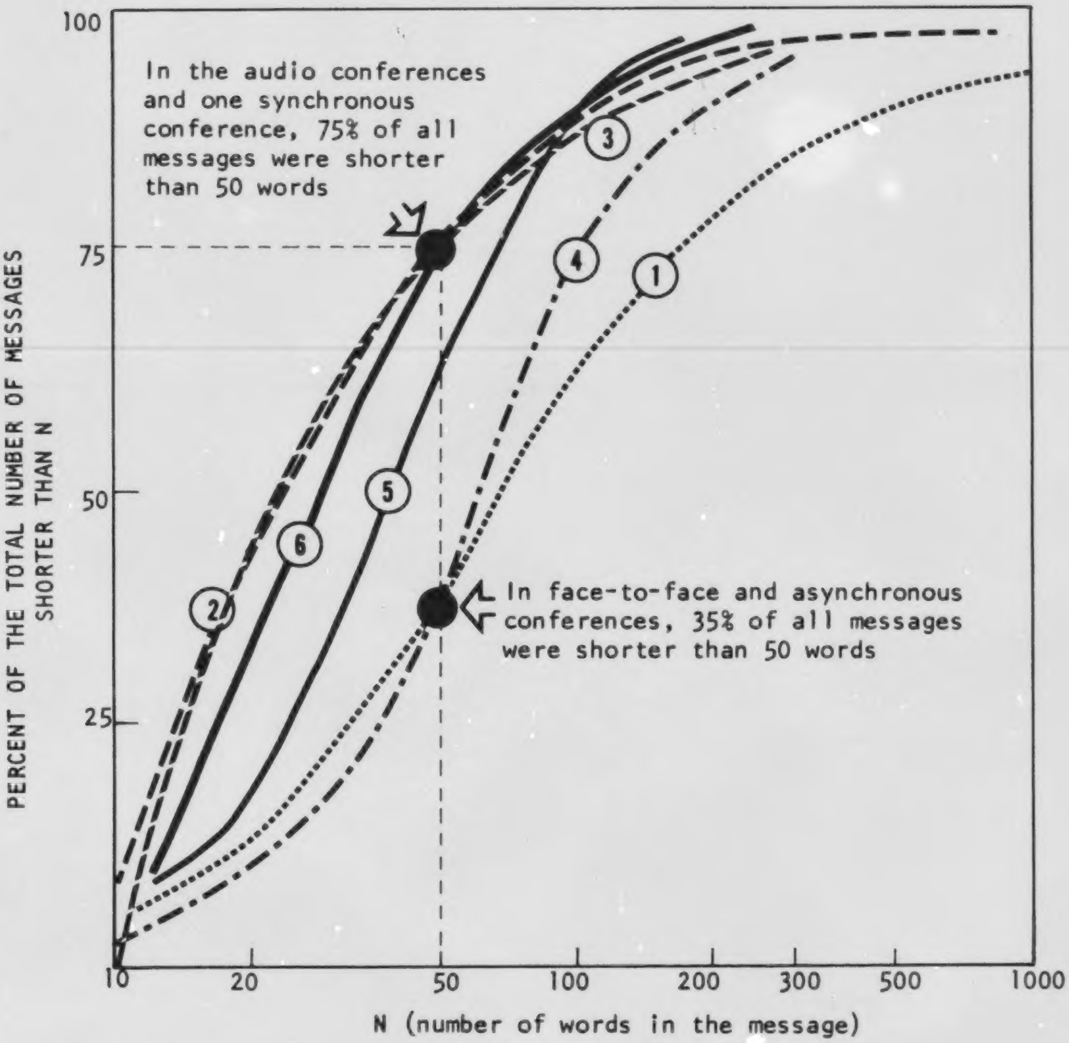


FIGURE 38

DISTRIBUTION OF MESSAGE LENGTHS IN FOUR CONFERENCES



Note the similarity between the two audio conferences. Asynchronous computer conferencing is close to face-to-face on this graph.

the relative strength of individuals in the organization. Alternatively, certain decision-makers, who owe their position to their mastery of one medium, may strongly oppose the introduction of another.

These observations, brief as they were, suggest that each medium is characterized by unique patterns of user participation and length and frequency of messages. Accordingly, the decision to use computer conferencing could be based not only on the availability and convenience of the system, but also on the relevance of these patterns to the organizational environment.

PART III. USER REACTIONS

The Character of Computer Conferencing
The Conferencing Tasks
The Conferencing Atmosphere
Technical Skills

PART III. USER REACTIONS

To explore users' reactions to computer conferencing, we sent questionnaires at two points during the study: one at the conclusion of the first year of field tests and the other at the end of the second year. It should be noted that a major methodological problem in this and similar field tests is the absence of pretest data on communication patterns. Such data are, of course, very difficult to gather. Participants must be willing to provide this information; many groups simply will not have such an incentive. However, future evaluations of communications media should attempt wherever possible to gather information *before* the new medium is introduced. Also, detailed studies could be made of those participants who do *not* adapt to the new medium. While this was not the purpose of this study, the resistance of these individuals could provide important sources of information for system designers and those considering new communications media.

Our questionnaire results indicate how the character of computer conferencing is perceived by the group and which tasks are best suited to this medium. They also provide insights into the conference "atmosphere" created by the medium and the importance of technical skills. However, it should be noted that the users who responded tended to be the most highly motivated to use the system. The 118 respondents (of 484 total participants) represent the heaviest users of PLANET. Forty percent of the 118 respondents were in the upper quintile for total number of sessions (a basic measure of total participation) and another 30 percent were in the second quintile. These respondents represent 53 percent of the total time used by all groups during this project. Most of the remaining participants were only involved briefly and gained little experience. Demonstrations were frequently given at test sites without our intervention or knowledge, for instance, and we had no way of recording names and addresses of *all* participants. Thus, the responses summarized here are those of experienced computer conferencing users.

THE CHARACTER OF COMPUTER CONFERENCING

The basic character of computer conferencing does much to shape the attitudes of the users. It is important to remember that this is a *print-based* medium: users have to type or get someone else to do it for them. Also, it is possible for communication to occur without all participants being "present" simultaneously. These two basic characteristics of computer conferencing are fundamentally different from face-to-face communication and video or audio teleconferencing. Perhaps for this reason, they also form the basis for many reactions to computer conferencing.

For example, they figure strongly in respondent perceptions of both strengths and weaknesses of this medium. When asked to check ways in which computer conferencing had been especially successful to them, they responded as follows:

POSITIVE REACTIONS

It worked well for the information exchange. (52%)

I could keep in touch with others. (56%)

I could participate at my convenience. (35%)

A written record was easily available. (32%)

I enjoyed using it. (17%)

Other. (39%)

These options on the questionnaire were based on a content analysis of earlier responses to open-ended questions. Yet, it is interesting to note that almost 40 percent still listed functions other than those given. Such factors as time-savings, inexpensiveness, and opportunities for a new communications experience were included in the "other" category.

When asked to indicate ways in which computer conferencing had been especially unsuccessful, the respondents showed less consensus:

NEGATIVE REACTIONS

I had computer problems. (26%)

Group members participated irregularly. (25%)

Discussions lacked focus. (19%)

There was not enough interaction among participants. (14%)

It took too much time. (10%)

It was hard to get to a terminal. (7%)

Other. (37%)

"Computer problems" included problems with the computer system on which PLANET or FORUM was running (the most frequent problem), as well as terminal or telephone line problems or difficulties with the program itself. Irregular participation is, of course, directly related to a basic characteristic of computer conferencing: there is currently no way to require regular participation. Problems of a lack of focus or interaction among participants can also be traced--at least in part--to the character of the medium: it is the price one pays for the flexibility of asynchronous communication. The "other" category includes such responses as poor preparation by participants, too short conferences, poor medium-to-task match, too expensive, and the need to type. It seems that the negative characteristics of computer conferencing are more difficult to isolate than are its virtues.

Still, the link to the basic character of computer conferencing is obvious. Whether this character will be perceived as a strength or a weakness is determined by other factors such as the tasks to be performed and personal style of communication.

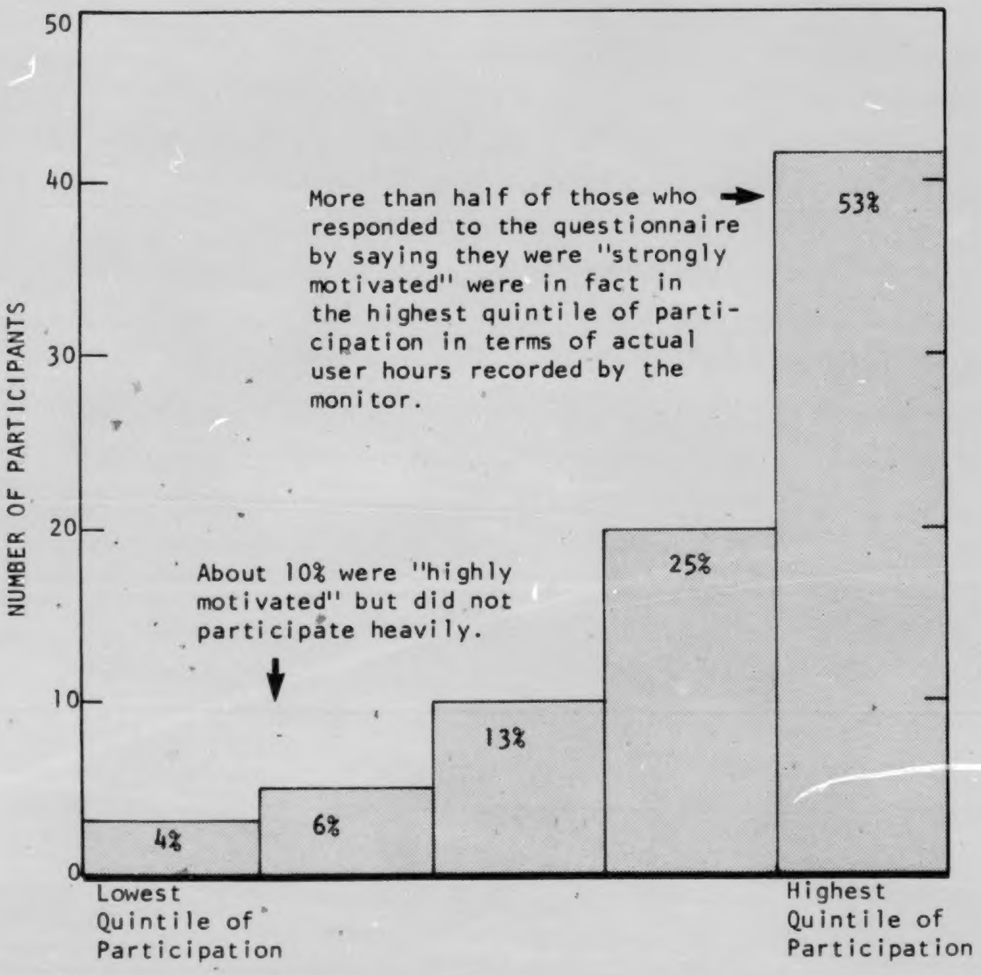
Many of the respondents were researchers who were working with colleagues in other parts of the country or the world. The written record provided an ongoing communication thread which stretched across time zones and national boundaries. Participants could "attend" the conference at their own convenience, see what had happened since they last attended, make their own comments, and leave. If they wished, they could also take some time *before* responding to reflect on a question or consult their library and *then* offer a response. Thus, the medium provided a continuous link with the written record serving a crucial function.

Motivation to participate becomes a basic factor in whether this vision of communication across geographic barriers can actually become a reality. About 75 percent of the respondents classified themselves as *strongly motivated to participate*. Also, Figure 39 demonstrates that those with strong motivation to participate also tended to be active participants. This finding is consistent with our earlier work in evaluating computer conferencing.* The perceived *need* to communicate is very important, perhaps because of the unique character of computer conferencing with its requirement for self-discipline in participation. Of course, these respondents also had competing demands on their time.

**Group Communication Through Computers, Volume 3,* Proposition 26, p. 160.

FIGURE 39

RELATIVE RATE OF PARTICIPATION BY THOSE RESPONDENTS WHO REPORTED A STRONG MOTIVATION TO PARTICIPATE IN THE COMPUTER CONFERENCES



More than half of those who responded to the questionnaire by saying they were "strongly motivated" were in fact in the highest quintile of participation in terms of actual user hours recorded by the monitor.

About 10% were "highly motivated" but did not participate heavily.

NOTE: A total of 85 persons rated their own motivation to participate as "very strong" or "strong." See Appendix B for exact wording of the questions.

THE CONFERENCING TASKS

In order to explore the utility of computer conferencing for varied tasks, a standardized set of questionnaire scales was used.* Figure 40 displays the responses in comparative form. For tasks such as exchanging information, asking questions, giving orders, staying in touch, or generating ideas, computer conferencing is clearly perceived as satisfactory by the 110 users responding to this question. For tasks such as bargaining, resolving disagreements, persuasion, or getting to know someone, computer conferencing is generally perceived as unsatisfactory or at least questionable.

Given the experience of these respondents, it is tempting to take these findings quite literally and simply refrain from using computer conferencing for complex tasks such as bargaining or negotiation. However, such literal interpretation seems premature. Even these respondents have had little experience in actually using computer conferencing, and it may be that at least *some* of these tasks could be performed via this medium if suitable strategies were developed. Furthermore, the aggregate statistics obscure some of the differences in the perceptions of different types of users. For example, Figure 41 shows the differences in responses for educators and scientists/engineers. The educators generally rate computer conferencing higher for all tasks, including bargaining and persuasion. We can only speculate about explanations for these differences: perhaps the scientists, who have generally had more experience with computers, are more critical of this use of computers. Perhaps the higher ratings by the educators reflect a "novelty effect." Perhaps educators are simply more facile at communicating via any medium than are scientists and engineers.

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*See Roger Pye, Brian Champness, Hugh Collins, and Stephen Connell, *The Description and Classification of Meetings,* Communications Studies Group, London, England, Paper P/73160/PY, 1973. Available from: Communications Studies and Planning, Ltd., 56/60 Hallam Street, London W1N 5LH, England.

FIGURE 40

RESPONSES TO THE QUESTION:
HOW SATISFACTORY DO YOU THINK
PLANET WOULD BE FOR THE FOLLOWING ACTIVITIES?

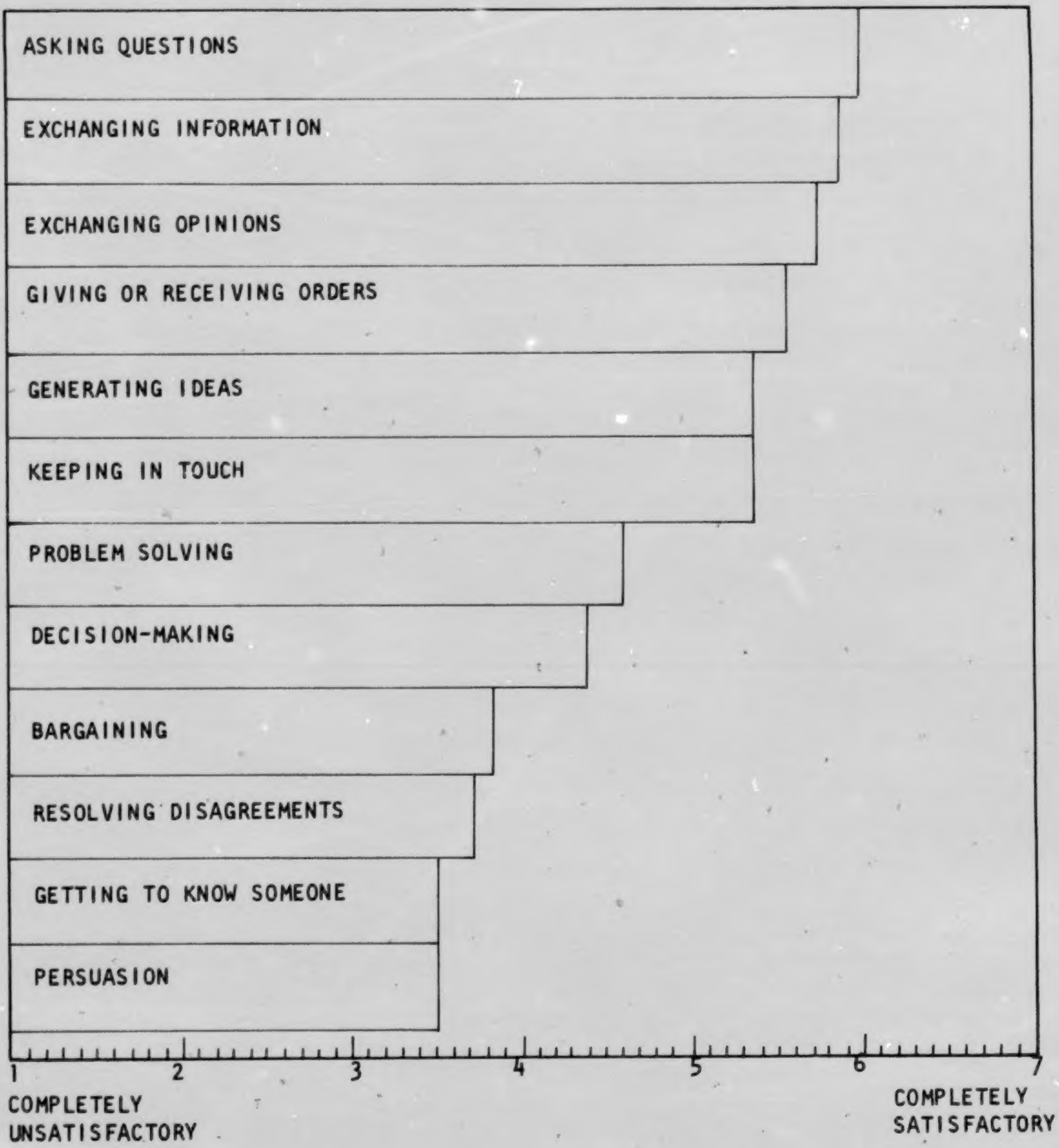
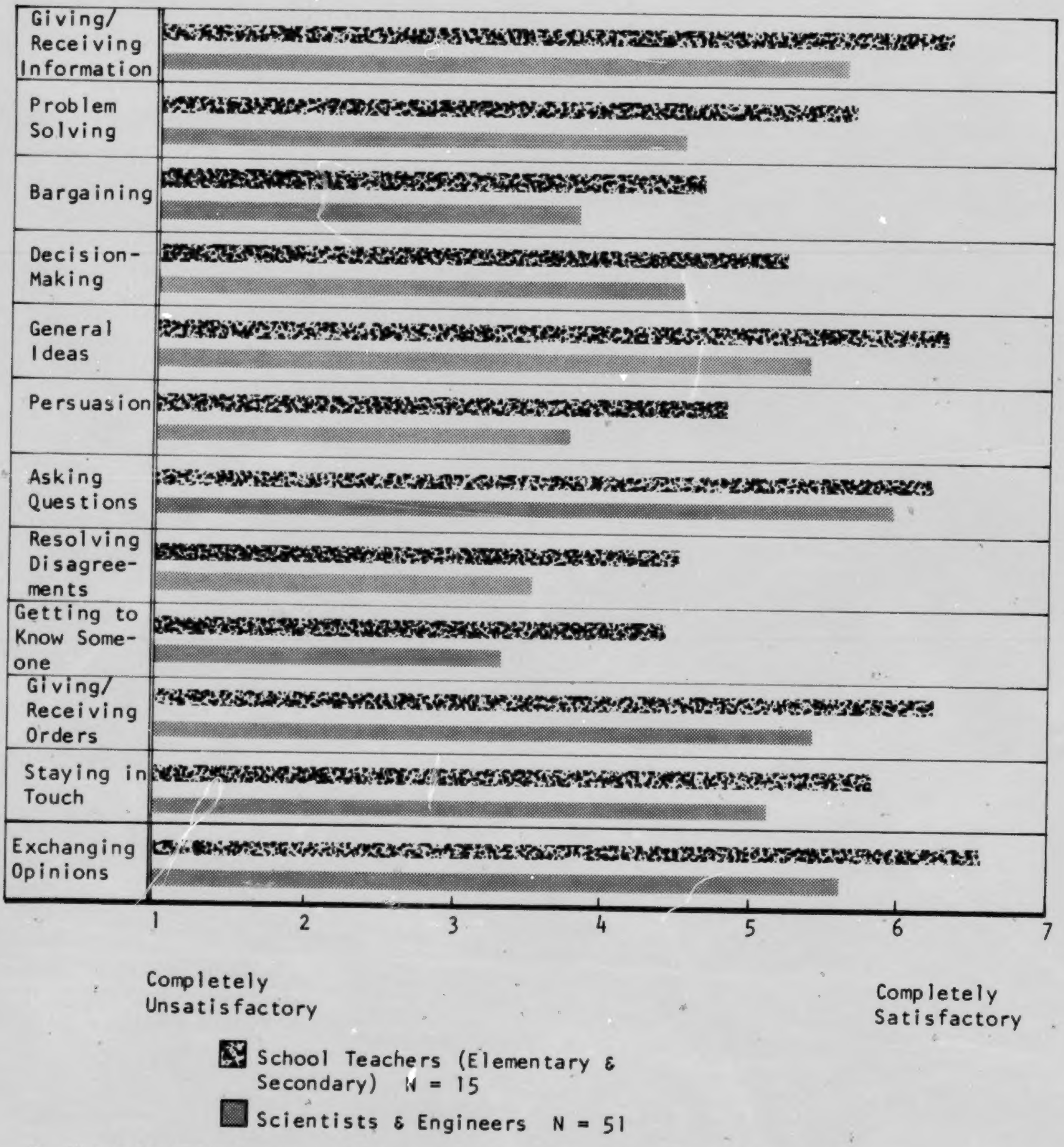


FIGURE 41

RESPONSES BY OCCUPATION TO THE QUESTION:
HOW SATISFACTORY DO YOU THINK PLANET WOULD
BE FOR THE FOLLOWING ACTIVITIES?



Note that the users with less technical backgrounds are consistently more satisfied with the medium.

Pye and Williams have recently compared reactions to audio and video teleconferencing using some of the same DACOM scales as we used in our studies of PLANET.* Figures 42 - 45 show mean responses given by users of the University of Quebec and the Remote Meeting Table audio systems and the Bell Canada and Confravision video systems. As Pye and Williams conclude, "*all* media were perceived to be more satisfactory for some tasks than for others. . . . However, there is relatively little difference between media for individual tasks, video seldom being perceived to be more effective than audio."** Reactions by the users of PLANET suggest that the Pye and Williams conclusion can now be expanded to include computer conferencing. There are no dramatic differences among perceptions of the task effectiveness of audio, video, or computer conferencing. While PLANET was perceived as slightly less satisfactory for "problem-solving" and "persuasion" than were audio and video, the differences were small.

Hammond and Williams, in a recent article summarizing the work of the Communications Studies Group in London, offer one interpretation of DACOM and other findings to date regarding audio and video teleconferencing. They conclude that "tasks which are low on interpersonal involvement are relatively insensitive to the use of audio or video teleconferencing instead of face-to-face."*** Conversely, they conclude that tasks which are high on interpersonal involvement *are* sensitive to the use of teleconferencing. "Here the relationship between the people involved is important, and medium of communication, which alters this relationship, affects the task outcome."**** This focus on the degree of interpersonal communication

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*DACOM stands for "Description and Classification of Meetings." See Roger Pye and Ederyn Williams, "Teleconferencing: Is Video Valuable or Is Audio Adequate?," *Telecommunications Policy,* June 1977, pp. 230-41.

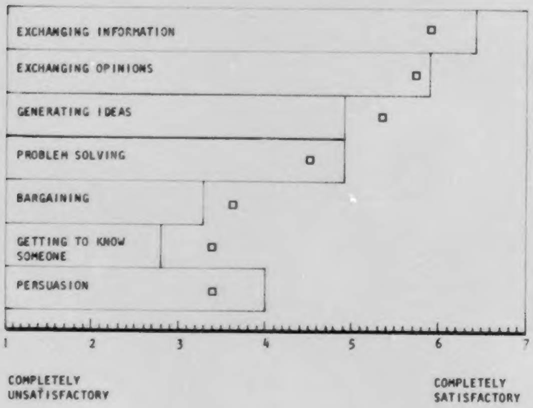
**Ibid., p. 234.

***Sandy Hammond and Ederyn Williams, "A Brief Review of the Work of the Communications Studies Group, 1969-1977," in Lorne A. Parker and Betsy Riccomini, eds., *The Telephone in Education, Book II,* Madison: University of Wisconsin-Extension Press, 1977, p. 101.

****Ibid., p. 102.

FIGURE 42

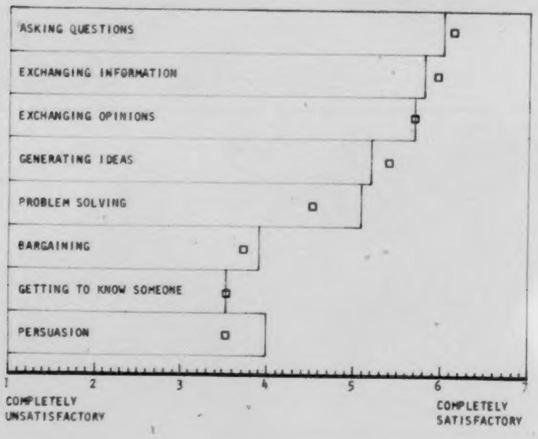
RESPONSES TO DACOM SCALES BY USERS AT THE UNIVERSITY OF QUEBEC* (AUDIO TELECONFERENCING)



□ Indicates the corresponding value for PLANET users

FIGURE 43

RESPONSES TO DACOM SCALES BY USERS AT BELL CANADA** (VIDEO TELECONFERENCING)



□ Indicates the corresponding value for PLANET users

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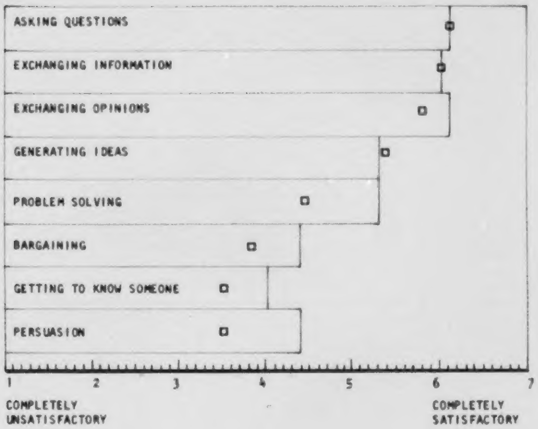
*H. Thomas and E. Williams, *The University of Quebec Audio Conferencing System: An Analysis of Users' Attitudes*, Communications Studies Group, Report P/75190/TH, 1975.

**E. Williams and S. Holloway, *The Evaluation of Teleconferencing; Report of a Questionnaire Study of Users' Attitudes to the Bell Canada Conference TV System*, Communications Studies Group, Report P/74274/WL, 1974.

FIGURE 44

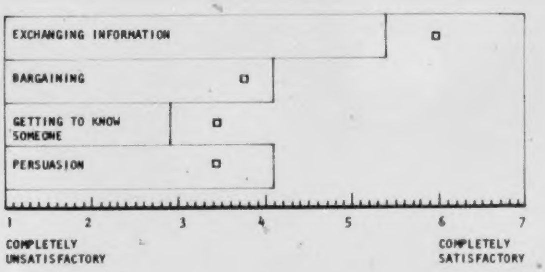
RESPONSES TO DACOM SCALES BY
USERS OF CONFRAVISION*
(VIDEO TELECONFERENCING)



▫ Indicates the corresponding value for PLANET users

FIGURE 45

RESPONSES TO DACOM SCALES BY
USERS OF THE REMOTE MEETING TABLE**
(AUDIO TELECONFERENCING)



▫ Indicates the corresponding value for PLANET users

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*B. Champness, *The Assessment of Users' Reactions to Confravision: Analysis and Conclusion*, Communications Studies Group, Report E/73250/CH, 1973.

**B. Champness, *Remote Meeting Table: Preliminary Report of a Questionnaire Study*, Communications Studies Group, Report W/72310/CH, 1973.

involved in a given task may prove more important than examining only the task itself. And each task type could involve varied degrees of interpersonal communication depending on each specific situation. Responses to the DACOM scales provide only a portion of the information one needs to decide whether or not computer conferencing is well matched to a given situation. One must also consider the interpersonal dynamics of the situation.* In cases where the dynamics are complex, the print-based medium of computer conferencing seems too constraining. Given the findings of the Communications Studies Group, it seems that the same could be said for audio and video teleconferencing.

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*In our early research, we have suggested five basic elements of group communication through computers: medium characteristics, task, group, individual, and rules for the meetings. The findings discussed here suggest that these elements cannot be viewed in isolation.

THE CONFERENCING ATMOSPHERE

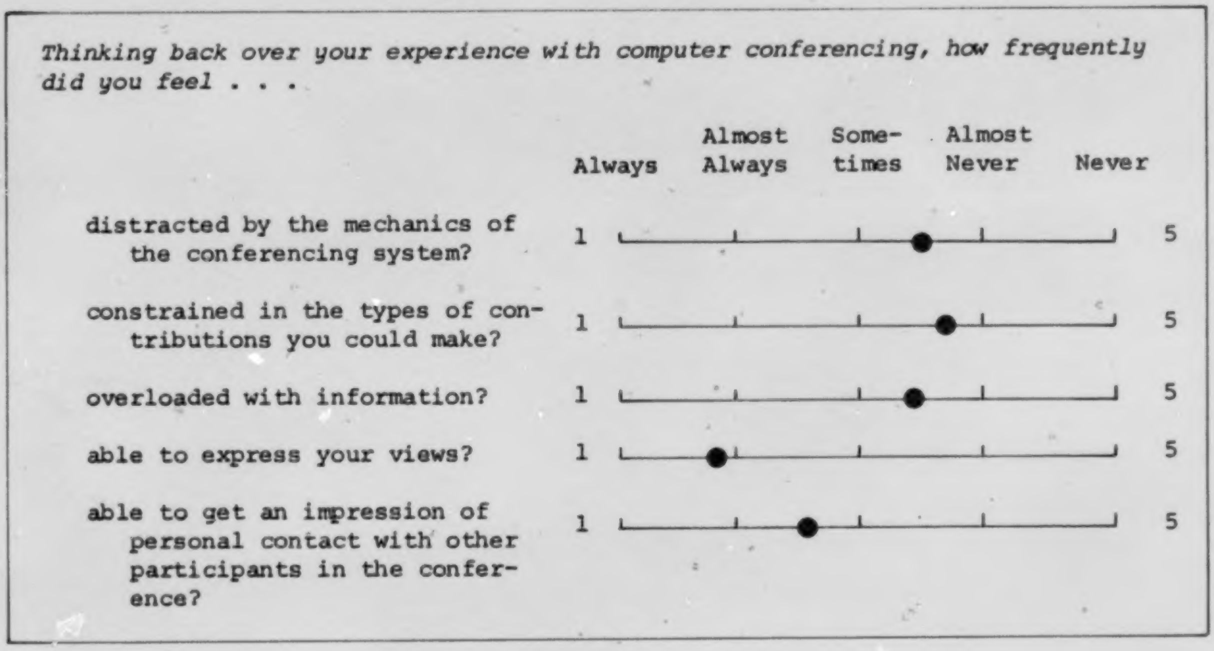
Figure 46 displays the results from a group of five questions which relate to the general "comfort" of using computer conferencing. Participants were rarely distracted by the PLANET program itself, and they rarely felt constrained in their contributions. (It is important to remember that these were experienced users who would thus be less likely to have such reactions.) Also, most were not overloaded with information, even though such a situation can certainly occur in computer conferencing. The last question is perhaps most important since it deals with the respondent's sense of personal contact with other participants. Most participants do report a strong sense of *personal* interaction within computer conferences. However, a significant number sometimes feel a lack of personal contact.

Some of the ambiguity about personal contact could be explained by different experiences in different computer conferences and by the general "atmosphere" created by the group leaders. Immediate interpersonal feedback is sometimes lacking, since it may be several days until others see one's messages; even then, there is no certainty that they will respond. Direct questions can often go unanswered in computer conferences unless someone demands a response. Also, the volume of information in a computer conference can become overwhelming and further discourage a sense of interpersonal interaction. The questionnaire results suggest that it *is* possible to have a strong sense of interpersonal interaction within a computer conference, but it is by no means assured. There are significant potential obstacles; conference organizers must guard against these if their goal is to develop a strong sense of contact.

Specific physical characteristics of computer conferencing again loom important in this assessment. The fact that participants communicate through typewriter computer terminals, for example, means that some may assign subordinates to sign in for them and retrieve their messages or even

FIGURE 46

SUMMARY OF MEAN RESPONSES TO QUESTIONS ABOUT GENERAL COMFORT WITH COMPUTER CONFERENCING



type in dictated responses. Personal passwords protect unauthorized entry, but the use of surrogates can inhibit levels of trust and security within a group. Private message exchanges may include questions like, "Is that *really* you there now, Ann?"

In our earlier research with computer conferencing, we suggested that participants' sense of personal contact would increase if they experienced more synchronous communication (where two or more people are present simultaneously).* As one user put it during a Kettering conference with a high level of synchronous activity:

> [331] Mesenburg 15-Oct-76 8:32 AM
> The high point for me has been a continuous "high" about each of you and your obvious commitment to IGE. My personality is tuned to people, not ideas. As a result, I find it difficult to consider a topic a "high." I have enjoyed tremendously the opportunity to work with each of you via Jennie.**

Synchronous meetings encourage personal exchanges and provide a sense of immediacy not present in the asynchronous mode. Also, more private message exchanges can increase the sense of personal contact. In such instances, a skilled leader or facilitator might make effective use of both private messages and brief synchronous meetings to develop a high sense of interpersonal contact. However, the aggregated data being reported here do not show a clear relationship between sense of personal contact and percentage of time spent in synchronous (rather than asynchronous) meetings. Figure 47 shows the percentage of synchronous time for those respondents who reported a high sense of interpersonal contact. It seems that synchronous meetings *may* help to create a sense of personal contact in a computer conference, but that a high percentage of synchronous conferencing time is not necessary to achieve such a sense.

Session duration may also influence the sense of personal contact. For the geologists who used FORUM, we find that those who had a sense of personal contact were those who spent more than five minutes (on the

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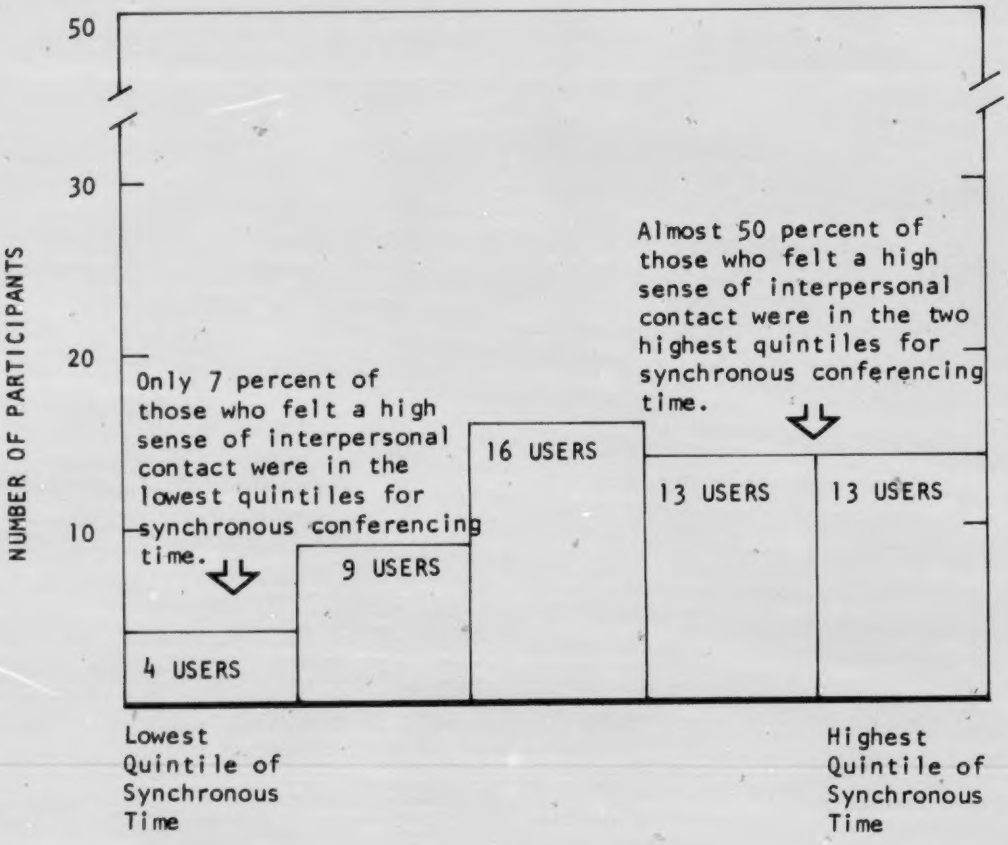
*See *Group Communication Through Computers, Volume 3*, pp. 161-2, Proposition 27.

**This group of users gave the system the nickname Jennie. See page 32.

FIGURE 47

RELATIONSHIP BETWEEN SYNCHRONOUS CONFERENCING TIME AND SENSE OF INTERPERSONAL CONTACT



average) in an activity. We can also consider the relationship between the sense of personal contact and private message sending behavior by introducing the concept of a "receiving ratio." This is the ratio of private messages received to all private messages (sent and received) for a single person; we express it on a scale from 0 to 1.00 where a participant with a ratio of 0 is a "perfect sender" who never gets a response to private messages and a participant with a ratio of 1.00 is a "perfect receiver" who absorbs private messages without responding (see Figure 48).

Those FORUM users who expressed a feeling of personal contact tended to be "receivers," with a ratio between .50 and .80. We can interpret this finding in several ways. The most likely explanation is that those who expressed a sense of personal contact tended to come into FORUM less frequently, found many messages waiting for them, responded to them with few private messages, and accordingly spent a fair amount of time at the terminal. Those users who felt little personal contact were coming in frequently and often found no new messages. Accordingly, their sessions were short, and they may have felt frustrated.

The feelings of an individual participant toward the whole group are frequently described as "warm":

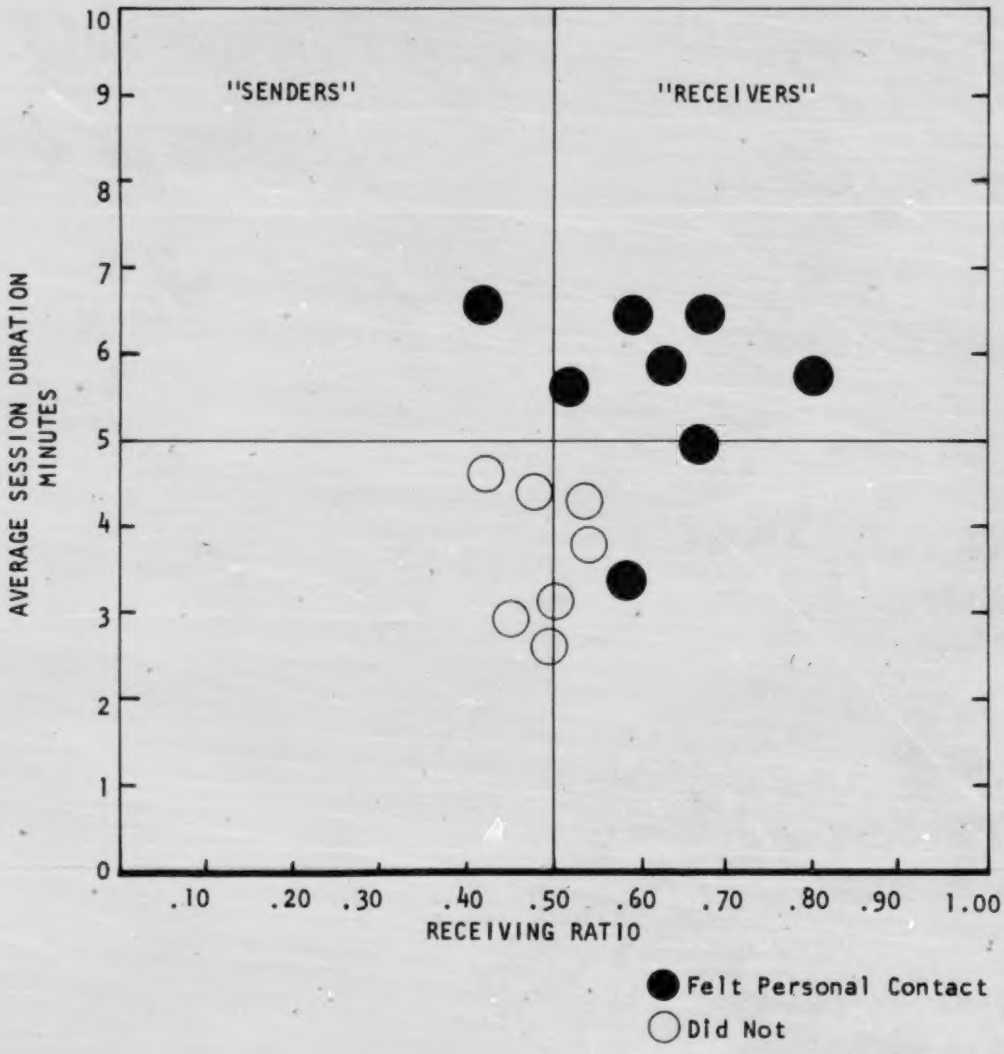
> [332] Hinzman 15-Oct-76 9:19 AM
> . . . I have truly benefited from this conference and will always look back on it with warm feelings. Many a day I have sat here reading the comments you have made, laughing at your sense of humor, thanking you for your help. Somewhere, someway, we'll all meet again and we'll not have to go through the superficial trivia of getting to know each other. It has really been super!!!!!!!!!!!!!!!!!!

The same feeling can be felt again when reading the actual transcript of the interaction. The impression of "instant contact with other minds" was frequently mentioned:

> [327] Wooten 15-Oct-76 5:17 AM
> I, too, think the high point of these weeks together was the "long miniconference" with everyone on line. We were able to give and receive instant feedback. The contact with so many minds with so much expertise has been tremendous. If I were to tell my boss of the advantages of a terminal, this would definitely be the main point. We would be able to receive help almost instantly . . . at least by the next day on a problem we had from someone who understands what we are talking about!!!!

FIGURE 48

RELATIONSHIP BETWEEN "RECEIVING RATIO," SESSION DURATION, AND SENSE OF PERSONAL CONTACT



Future applications of the medium, in our view, should capitalize on the ability to awaken and nurture such feelings among the group members.

TECHNICAL SKILLS

Because computer conferencing requires some new skills for most users, we have analyzed the effect of individual learning on usage patterns.* Initial learning in PLANET is very fast--our training sessions are typically conducted on the telephone and last 15 to 20 minutes. Beyond this point, users develop their own patterns, and we begin to observe some adaptation. Two variables seem to change with learning: rate of message exchange and typing speed. It appears that both increase as users gain experience with the system; then, after the first 20 sessions, these parameters tend to stabilize (Figures 49 and 50).

Poor typing is one of the major obstacles cited to more widespread use of computer conferencing. In fact, typing speed has a complex relationship to the use of the system. Alphonse Chapanis has found in his controlled experiments with audio, video, and input/output typewriters that typing ability per se is not an important factor in determining the time it takes two test subjects to solve a simple problem.** In our earlier research on computer conferencing, we have offered evidence in support of this conclusion.*** The current study offers further support that typing ability is not a prerequisite for successful computer conference usage. However, only 13 percent of the respondents to this questionnaire rated their own typing as "poor" or "very poor." Thus, we have only a small group

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*In the section on the Evaluation of Organizational Styles, we considered the effects of *organizational* learning.

**Alphonse Chapanis, "Interactive Human Communication," *Scientific American*, March 1975, p. 36. A more recent conclusion from Chapanis reads: "Typing skill does not appear to be a significant factor in the kind of communication with which we are concerned." See A. Chapanis, "Interactive Telecommunication," *Proceedings of the National Telecommunications Conference of the IEEE*, Dallas, Texas, November 1976.

****Group Communication Through Computers, Volume 3*, pp. 62-3 and 112-3.

FIGURE 49

EFFECT OF EXPERIENCE ON PRIVATE MESSAGE SENDING

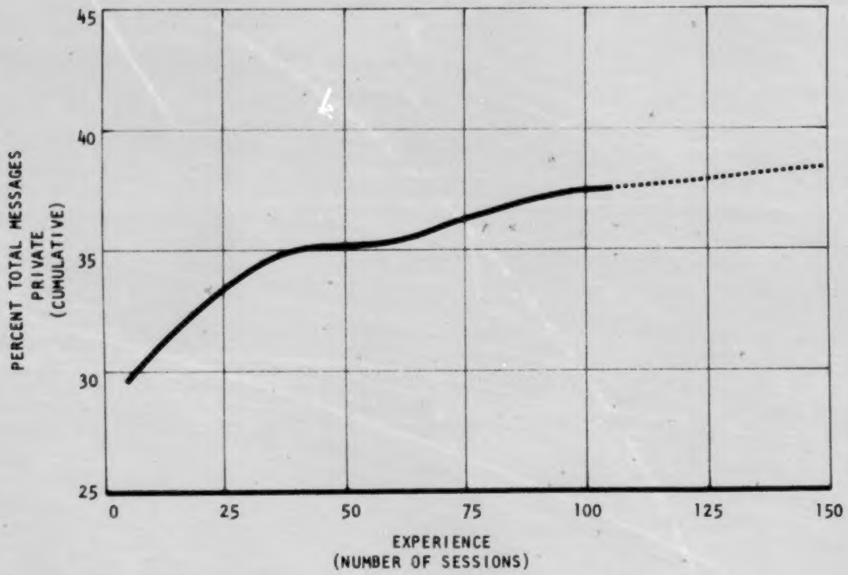
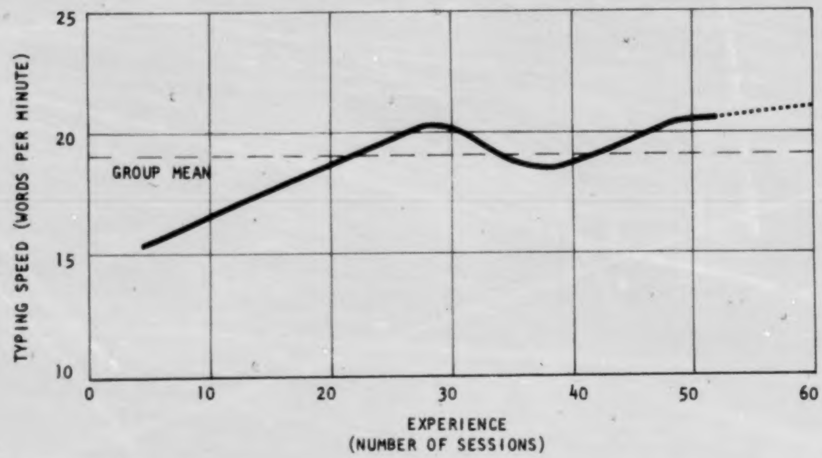


FIGURE 50

EFFECT OF EXPERIENCE ON TYPING SPEED



of poor typists from which to draw conclusions. And this situation is complicated by the fact that communicating in a computer conference involves *more* than just typing.

A participant in a computer conference is called upon to perform such activities as (1) typing, (2) composing messages, (3) reflecting on the messages, (4) critiquing his or her own messages, and (5) editing and correcting spelling. The PLANET monitor measures the length of time from the beginning to the end of a message. However, if the participant pauses to reflect, goes back to correct a spelling mistake, or even receives a phone call and stops typing for a period of time, the monitor will still keep ticking away the time. What is being measured, then, is not merely typing speed but actual communication speed within PLANET.* The ability to type certainly helps a novice user, but he or she must still become comfortable composing, reading, and interacting via this new mode. Also, the new user must learn basic commands within PLANET, as well as any which might be required by the computer network on which PLANET is residing.

In examining the results of PLANET monitor measurements of communication speed, it becomes clear that this measure is related to basic measures of participation such as number of sessions (Spearman rank order correlation coefficient = .227, N = 421), public message sending (r_s = .349), and private message sending (r_s = .253). Those who rank high on those communication skills required to use PLANET, including typing ability, do tend to be the same people who rank high on participation measures. A poor typist will not be excluded from the use of computer conferencing, but the skill will certainly be helpful.

A related question concerns prior familiarity of users with computer technology. As Figure 51 shows, a significant number of the respondents (more than a quarter) had *no* previous experience with computers before they began to use PLANET. Such lack of computer experience does not seem to

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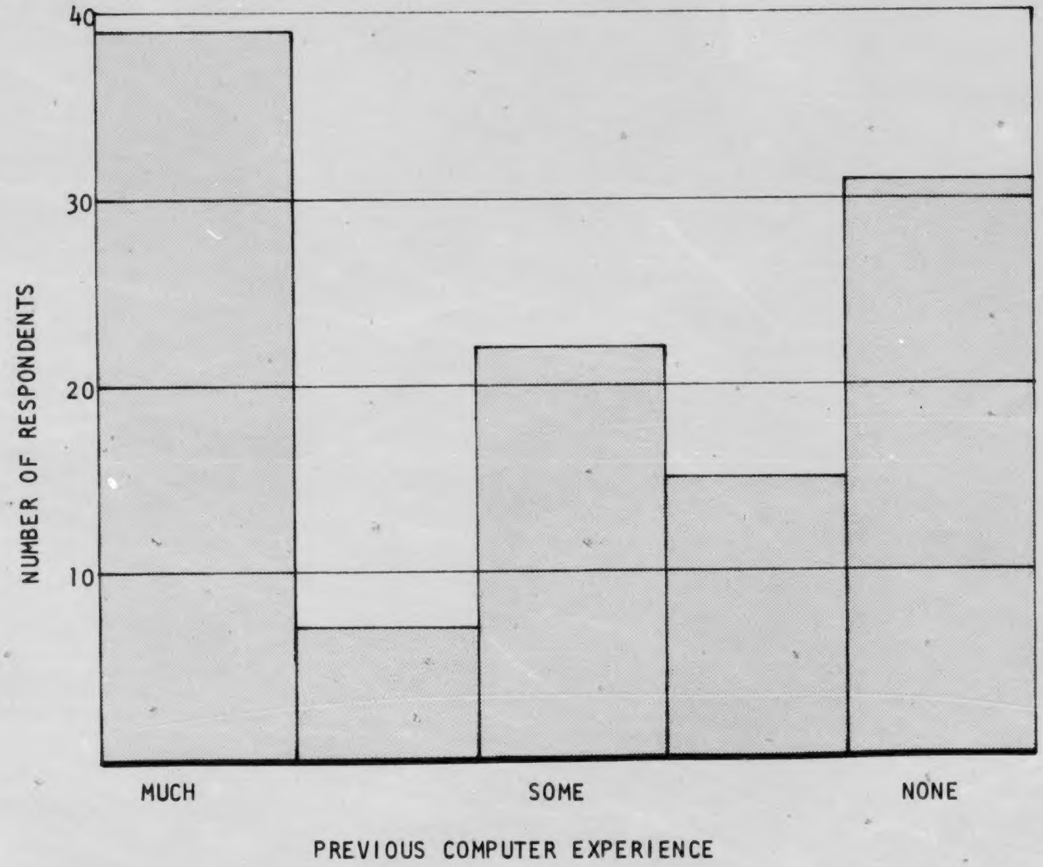
*In our previous research, we found positive correlations between respondents' assessment of their own typing ability and typing speed as measured by the monitor. See *Group Communication Through Computers, Volume 3*, p. 150. In the current study, however, there is no such correlation. (Kendall's Tau = -.08; significance = .15.)

FIGURE 51

COMPUTER EXPERIENCE OF QUESTIONNAIRE RESPONDENTS PRIOR TO THE USE OF PLANET



offer any impediment to the use of computer conferencing. As we reported in our initial tests of computer conferencing,* computer expertise is not a prerequisite for successful computer conferencing. Comparisons of respondents' assessments of their own computer expertise with overall measures of participation show no clear relationship. Those with no computer experience were often in the upper quartile of participation and those who were computer experts were often in the lower quartile. While experience with computers might help in overcoming any initial fears or reservations about *any* use of computers, it does not seem necessary for the use of PLANET.**

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*Jacques Vallee et al., *Group Communication Through Computers, Volume 3,* pp. 163-4.

**New users of computer conferencing who are not experienced with computers may, however, need more initial assistance with terminals, log-in instructions, etc. These factors are more related to the current culture of computers in general, however, than the characteristics of computer conferencing itself.

CONCLUSION:
EIGHT ISSUE AREAS

The data we have gathered on the long-term use of PLANET by organizations provide several insights into the economic, social, and managerial issues surrounding the use of computer conferencing. In this final section, we present eight issue areas summarizing the conslusions which we feel are justified by the data in this report.

ISSUE AREA 1

THE RELATIONSHIP BETWEEN COST AND USAGE PATTERNS

The cost of computer conferencing is likely to be a significant factor in determining patterns of usage and should not be underestimated.

The economics of new electronic media are difficult to clarify, either because vendors prefer to confuse the issue or because researchers are not clearly confronted with the true costs of their own use of these systems. No cost statistics have been computed for earlier systems, and from the literature, it is difficult to interpret the actual costs of applications at the Office of Emergency Preparedness or the use of MAIL on the Tymshare network and SNDMSG ("Send-Message") on ARPANET. Projections of future costs include price tags as low as $2 per user hour. In our estimation, such figures are unrealistic given the economic trends in the network environment upon which computer conferencing is predicated.

The cost of computer conferencing is likely to be a significant factor in determining patterns of usage and should not be underestimated. Consider the cost data gathered in this study: the costs of the 148 conferences run during our study are distributed as follows:

Number of Conferences	Cost
61	<$100
22	100 - 200
31	200 - 500
14	500 - 1,000
14	1,000 - 2,000
2	2,000 - 5,000
3	5,000 - 6,000
1	6,000 - 7,000

We have also computed the cost per user per month for all user organizations; the result is plotted in Figure 52. The average value has been about $38, but the cost decreased during the study. Because the organizations had to pay their own way, they had an incentive to use the system in the most cost effective way--reducing their time online and perhaps eliminating some of the less important or less efficient uses of the system. Thus, it seems likely that cost will influence the user's choices about how to use computer conferencing.

The use of private messages is a case in point. As indicated in Part II, the private message-sending rate dropped continuously for all organizations except Kettering. Private message sending is often considered a "frill" and many groups were encouraged to use the telephone, which might be less expensive for such private communication. This observation does not mean that cost will always discourage the use of private messages. The telephone simply might not fulfill the needs of the user at that time. Many private messages have been sent asynchronously when a single user was in the system and the intended recipient of his message was asleep, eating lunch, or away from the terminal for some other reason. The sender clearly had the option of picking up the telephone and decided not to use this option. In most cases, the sender wanted the recipient to have a record of the private message. Why not send a telegram then? Aside from the question of convenience and cost (PLANET costs only about 67 cents for 20 words of text, as opposed to $2.50 for a mailgram*), the fact is that private messages are an integral part of the substantive discussion although they are invisible to the reader of the public transcript. Many private messages also involve training and technical support information that simply does not belong in the public transcript. In the cases when private messages were actually

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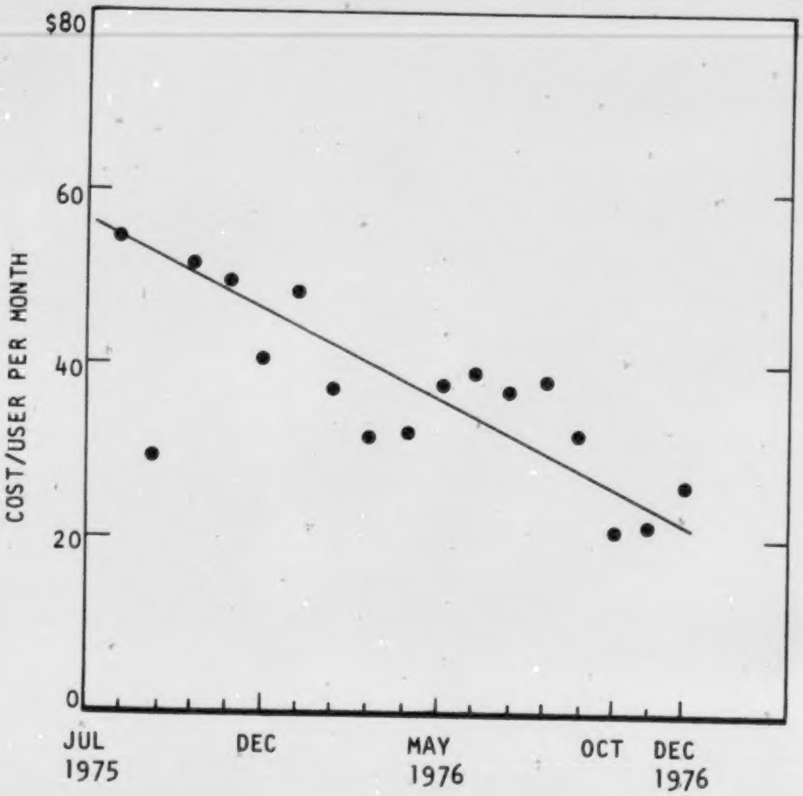
*One must qualify how the cost is computed. The cost figures we have quoted include the sending of a message and the reading of that message by all the recipients. (We have divided the total cost for all users by the total number of messages exchanged.) Other authors have quoted only the machine cost for *sending* an average message, and accordingly they publish extremely low cost figures. In PLANET, the average user types at 20 words a minute. The average cost for sending a 20-word message would therefore be 33 cents if computed that way.

FIGURE 52

COST PER USER PER MONTH FOR ALL ORGANIZATIONS



turned off, we have noted an increase in public verbosity. Thus, users will consider both convenience *and* cost in using computer conferencing. Finally, it is important to clarify just what is meant by the "cost" of a computer conference. The PLANET system has been running on TYMNET since October 1974 at an average hourly *computer utilization* cost of about $16; this cost includes a $10 to $12 hourly charge for the time of terminal connection and may drop somewhat in the future as vendors lower their rates for connect and computer time. The true costs of such a system, however, involve more than just computer utilization and are closer to $20 per hour. Six major components* should be considered, both in computing current costs and projecting future costs of a computer conference (see Figure 53):

1. Terminal Equipment. In our field tests, we have had to rent or lease terminals from manufacturers and from the networks. Tymshare, Inc., and Texas Instruments, Inc., offer the same equipment at comparable rates. As the use of computer conferencing becomes more common, the cost of terminals can be spread among more users and more projects; it is expected that, within five years, terminals will become an overhead item (like a typewriter or a telephone) at many research institutions. This component of the cost will thus tend to decrease, although we may see the replacement of printing terminals by more expensive intelligent and graphic terminals.

2. Communication with a Network Port. The cost of accessing the network may be quite significant to users outside of metropolitan areas served by commercial networks. In the PLANET conferences, most participants could access the network with a local phone call; a few users in areas not served by the network had to make toll calls. The geographic coverage of the major networks is expanding rapidly, however. In addition, future technology could eventually make networks available to rural areas.

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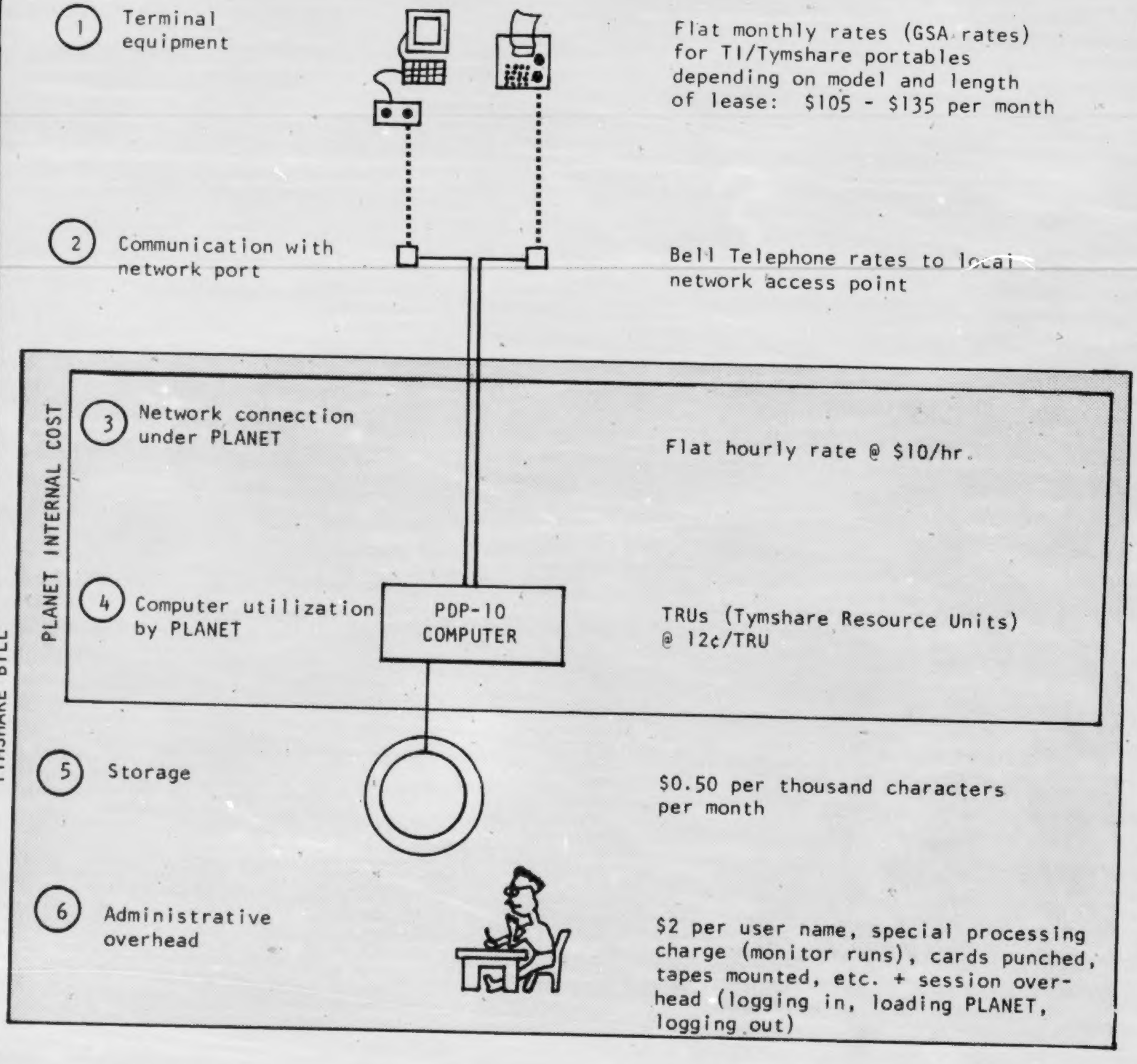
*These do not include considerations of participant salaries, editing of transcripts, and royalty on the use of a program package (not applicable here, but to be taken into account with commercial systems). Nor do they include the costs of marketing, training, facilitation, and billing, which could be considered as four additional costs components.

FIGURE 53

SIX COMPONENTS OF COST IN A COMPUTER CONFERENCE



① Terminal equipment — Flat monthly rates (GSA rates) for TI/Tymshare portables depending on model and length of lease: $105 - $135 per month

② Communication with network port — Bell Telephone rates to local network access point

③ Network connection under PLANET — Flat hourly rate @ $10/hr.

④ Computer utilization by PLANET — TRUs (Tymshare Resource Units) @ 12¢/TRU

⑤ Storage — $0.50 per thousand characters per month

⑥ Administrative overhead — $2 per user name, special processing charge (monitor runs), cards punched, tapes mounted, etc. + session overhead (logging in, loading PLANET, logging out)

3. Network Connection. The Tymshare network currently charges $12 per connect hour. Since this is the largest component of the conferencing cost, the connect time rate must decrease dramatically in order for teleconferencing to make a commercial breakthrough. Network rates are expected to decrease slowly with more efficient technology for message or packet processing.

4. Computer Utilization. The use of the computer has been billed according to the number of "resource units" used in a given session. This charge has averaged about $6 per hour. In the future, more efficient time-sharing systems, an expanded number of ports into the computer, and the use of mini- or microprocessors for local intelligence will decrease the cost of computing.

5. Storage. A conference is a file that resides on a mass storage device. The participant is charged for this file at a typical rate of 45 cents per 1,000 characters.

6. Administrative Overhead. The bill received by the user from the network each month covers not only the computing and connection charges but also a number of other items, such as:

- A flat charge of $2 per user name
- A charge for special handling of tapes or cards and the runs of the monitor program that computes and lists the statistics
- Session overhead at a rate of about two "units" per session, representing the amount of computer resources used to log-in and to load the PLANET program

The need for the computer supplier to break even on the use of the system will demand that storage and administrative charges remain significant. However, there is still room for improvement with larger, less expensive memories and more efficient handling of user accounts and secondary services. One should also keep in mind, on the negative side, that when conferencing usage spreads, the files holding the discussions will become much larger than anything currently observed, distorting many usage patterns.

ISSUE AREA 2

THE SIZE OF THE USER BASE

> *Computer conferencing will require a very large user base to be economically viable.*

The time of day when computer conferencing is used, the average usage time per day, and the user "turnover" rate have important implications for the economics of computer conferencing. As indicated in Figure 19A, system usage over the workday has been bimodal, with peaks in the morning and afternoon. If we assume that all computer conferencing usage is supported by a single installation, we can calculate the usage pattern *as seen by this hypothetical computer*. In the United States, this usage pattern would still be a bimodal distribution, but over a 12-hour extended workday. During this period, the ratio of peak to average usage is about 16. This ratio is based, however, on access to lines which would be unrealistic for a computer conferencing vendor: users in this study had many more lines available than the users actually needed. If offerors of computer conferencing services wanted to establish a .99 probability that each user would be connected, the ratio would change to 7.

Murray Turoff* has assumed a ratio of 2 with random arrivals of users following a Poisson distribution** over a 15-hour day. This ratio seems somewhat optimistic *unless there is a very large user base*. Our measured value of 7 would of course decrease with a larger number of users (a ratio of 1.7 for average peak to average usage is the lower bound). However, our observed distribution is not a Poisson distribution; instead, it

---

*Murray Turoff, "Cost and Revenues of Computer Conferencing," *Proceedings of the Third International Conference on Computer Communications*, August 1976.

**Poisson distributions are typical of the queuing process that takes place when a communication system (such as a telephone network) is used by a large number of independent customers arriving at random intervals. In contrast, output from a production line is *not* a Poisson distribution (since the conveyor belt moves at a uniform speed), nor is the queue at a movie theater, where arrivals "peak" just before the feature starts.

is strongly distorted as a result of large synchronous meetings. This distribution suggests that, to service such meetings, an acceptable service level might have to be higher than .99 probability of being connected.

Table 9 traces the average usage time per workday per user over the 18-month period from July 1975 to December 1976; it also presents the monthly totals for new users and loss of old users. The average usage time per day is 7.6 minutes. There are about 26 people each month who use the system for the first time and a monthly average of 20 "dropouts." This high turnover rate indicates that, at least in our study, a large portion of usage has been of limited duration. The turnover rate also has implications for the level of support needed to introduce and sustain a user population until computer conferencing is well established within the culture. In the field tests reported here, 8 percent of all usage time was recorded in demonstration conferences.

These observations imply that computer conferencing requires an extremely large user population to be economically viable. Such a very large user population in turn requires a substantial initial investment in marketing and support personnel, communication costs, accounting structure, and user-level training and documentation compared to the revenues expected from each user. These costs are further accentuated by the high turnover rate of the user population base. They can be quite easily overlooked in predicting costs for computer conferencing based solely on technical and administrative considerations.

TABLE 9. USAGE PATTERNS BY MONTH

Year	Month	Number of Active Users	Average Usage Per Workday Per User (Minutes)	Number of New Users	Number of Dropouts
1975	July	41	12.5	41	-
	August	35	8.8	12	18
	September	53	6.0	25	17
	October	72	9.9	30	11
	November	93	8.7	29	8
	December	97	8.2	19	15
1976	January	106	9.4	24	15
	February	118	7.2	26	14
	March	97	6.7	18	39
	April	111	6.5	30	16
	May	118	7.2	28	19
	June	143	8.3	45	20
	July	149	7.6	40	34
	August	135	8.0	27	41
	September	151	7.2	32	16
	October	143	4.6	18	26
	November	133	4.8	21	31
	December	146	5.0	19	7
	Average	-	7.6	26	20

ISSUE AREA 3

CONFERENCE LOGISTICS

Preplanning is at least as important in computer conferences as in face-to-face conferences.

In our field tests, we have observed both successful and unsuccessful conferences. While our research design has not systematically explored the reasons for the unsuccessful conferences, we have noted that "preplanning" seems to be one crucial variable. Often, a group will expect a computer conference to develop spontaneously around a general theme. No group leader is designated and no facilitation is organized. Such a group may generate a large number of disconnected entries, with each user making a speech about his or her personal views. Or the conference may simply die for lack of interest because no one has thought about the need to structure issues and promote interaction. It appears that such users expect the computer itself to create a focus for their interaction when, in fact, this responsibility should be shared by the human participants.

The availability of a computer conferencing activity does not ensure communication any more than the availability of a conference room ensures a successful face-to-face conference. Many of the problems cited by questionnaire respondents in this study could be eliminated--or at least minimized--by better preplanning. Recall that 25 percent of these users cited irregular participation as a disadvantage of computer conferencing. Another 19 percent claimed their conferences lacked focus, while 14 percent did not feel that there was adequate interaction. All of these complaints can be related to characteristics of computer conferencing: the medium does not interrupt participants, so they don't have to participate if they are busy or distracted; the nonsequential nature of computer conferencing means that users do not have to respond to comments in an orderly fashion; and the lack of nonverbal cues can create a feeling of low interaction among participants. At the same time, however, everyone has probably attended a face-to-face meeting in which these same problems have existed.

In planning computer conferences, as in planning face-to-face meetings, it is important to consider three types of issues:

- First are the *technical* issues. Participants, designated in advance, must have adequate access to terminals as well as documentation and training in the use of the system. They must recognize what they can do to ensure continuity of the medium and what responsibilities lie with equipment and service suppliers. Cost and availability data should be supplied to them ahead of time so that they can plan their individual participation styles in advance.
- Next are the *substantive* issues. Successful computer conferences are typically those in which the need to communicate is high and the issues are well-defined. The conference topics do not have to be narrow and technical in nature, of course. In fact, we have seen groups tackle lofty intellectual problems successfully: the conferences sponsored by Deer Communications, Systèmes Informatiques de Gestion, and Kettering are examples. The key, however, has been to keep the attention of the group focused on a single topic at a time--and a topic which is relevant to each of the participants.
- Finally, there are *group process* issues. These concern the selection of participants who have something to contribute and the development of incentives to participate. A conference organizer will also need to anticipate problems which are likely to arise due to concerns about status and roles, and devise strategies to address those concerns. Simple procedures, such as distributing biographies of the participants beforehand, can solve many group process problems before they originate. These require special consideration before each conference begins.

These issues are not really computer science issues. It is not realistic and probably not even desirable to expect computer scientists to eliminate the need for social and managerial decisions in the communication process. Instead, it seems more important to learn more about the new set of choices which are created by the introduction of a computer-based medium.

ISSUE AREA 4

LEADERSHIP PATTERNS AND SKILLS

Strong leadership is essential to the effective use of computer conferencing.

A major factor in the successful conferences in this study has been the group leader. Two types of leadership functions have emerged in our observations: *organizing* or taking responsibility for contacting participants, defining a set of priorities for the conference, and obtaining funds to support it; and *facilitating,** including training the participants and assisting them in the use of the medium *(individual facilitation)* as well as "lubricating" the social process to help the group develop an effective communication style *(group facilitation)*. These functions may be performed by one person or may be divided between two or more people.

Not surprisingly, the usage patterns of such group leaders differ from other participants. For example, they appear to have slightly higher message-sending rates (6.9 public messages per hour versus 4.8 for other participants), although average length of messages is the same. They make greater use of editing characters and commands. They have higher typing speeds and spend more time typing. However, we have found no significant difference in synchronous usage or in use of the system outside of office hours

The group leaders need a special set of skills beyond the effective use of the public message mode. They should, for example, know the limits of the medium and be prepared to switch to another form of communication such as telephone or personal meeting. Eric Walther makes such a judgment in the following entry:

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*At a workshop for facilitators held in Menlo Park in the early phase of the project, the following persons participated: Dick Doell, USGS; Brad Gibbs, NASA; Randy Hughes, Lockheed; Ruth Ann Mendenhall, Lockheed; Ron Michelson, EPRI; Fred Weingarten, NSF; Thad Wilson, IFTF; Betsy Yount, USGS. Other group leaders who made a significant impact on the project are: Gerald Askevold, USGS; Fred Mascy, NASA; Wasyl Lew, NASA; Kent Collins, Carol Smith, Lyn Simmons, and Eric Walther, all at Kettering; Sam Morris, Granger Morgan, and Don Austin, ERDA.

> [204] Walther (Org) 27-Apr-76 1:44 PM
> Jim Newman and Wolfgang believe we should get together in person, augmenting this computer conference. I agree. I also think the 5-9 July WMO maize conference at Iowa State U. is an excellent opportunity. Most of us will be there, including me. If you all agree, I suggest we definitely meet there. Any of you who were not planning to attend may find our meeting enough of a reason to attend the whole affair. We must choose a specific time to get together. Wolfgang, How about the evening of Monday, 5 July for a meeting of this group?

Another task of the group leaders is to schedule synchronous "meetings" and to run them productively. In the IGE conference of Kettering, one of the participants had asked the group to assist her with a specific problem. The facilitator scheduled a "miniconference" during which most of the participants were "online" together for approximately two hours. What made this "miniconference" unusual was the participation by school principals and other educators who, although not participating directly, were situated at sites where the terminals were located. They acted as experts or resource people by responding to group questions:

> [637] Vanlandingham 6-Aug-76 8:26 AM
> Good news group!!! Dr. Mary Heggler, ESAA Project Manager, has just walked in. One of the major components of her project is a parent training component. And family training components. She is going to give you some suggestions, Reba.
>
> [704] Hinzman 6-Aug-76 9:41 AM
> Barb, Tony Molinaro says thank you for response #702.
>
> [706] Vanlandingham 6-Aug-76 9:42 AM
> Tony Molinaro!!!!!!! Super! Is he there? Hello from me. You don't need me to tell you about special education with Tony in your midst. Glad I said the right thing, though!

In all conferences, there is a great need for the group leaders to place before the participants a clear set of priorities and assignments; they also need to open clear avenues for the expression of dissenting views:

> [382] Walther (Org) 26-May-76 2:01 PM
> Gentlemen, as you can see, we are using this computer conference for three purposes: (1) to work on the report of the current North

> American study, (2) to design the global study, and (3) to talk with each other about our mutual interests in aspects of grain production and climate. I think all three purposes are worthwhile. Possibly some of you don't. If any of you feel we are spinning wheels or using this medium of communication inefficiently, please let me know in a private or anonymous message.

Sensitivity to the reactions of the participants is a very important attribute of a skilled facilitator. Users are often busy people who dislike wasting time, and they will not be slow in making their reactions known:

> [55] Caplinger 3-Sep-76 6:44 AM
> To all. I am concerned that we are not drawing together our plans for ICMA conference. Computer is proving invaluable for info transmission, but we are deviating from original purpose. Suggest that after your holiday on Monday we review conference plans and start to finalize them.

The group will generally look to its leaders for guidance in usage patterns. The Kettering facilitators encouraged synchronous interaction, with very positive results:

> [112] Simmons (Org) 14-Jul-76 6:24 AM
> I'll encourage anyone else to set up similar synchronous dialogs as in entry #109 and announce the date and time to the rest of the group in the event others can join in. I also think it might be a good idea if you find yourself checking in to PLANET at about the same time of day on most days that you could share that with us so we could be aware of when the others "might" likely be on!

Finally, the group leaders should serve as *integrators*. The system provides them with simple and powerful facilities to do this, since the entire transcript can be reviewed and specific entries can be quoted by number:

> [286] Simmons (Org) 2-Jul-76 10:02 AM
> Loren has requested feedback for planning a state IGE conference in entry #113. He has commented on the role of the state department in coordinating IGE statewide in entries 210, 213, and 219. Lorraine has expressed an interest in the role of the state department in entries 212 and 214, and Jack has related that his state has an IGE facilitator also.

Taken together, these skills provide a general description of the required profile for a good conference leader.

ISSUE AREA 5

USER WORKING PATTERNS AND SKILLS

Users of computer conferencing must develop new communication skills, and this learning process may extend well beyond the period of this study.

First-time users of computer conferencing usually have no model for the kind of communication which is possible via this medium. Quite predictably, they will generalize from face-to-face meetings or letter correspondence. Over a period of time, this generalization effect will wear off and communication authentically related to the medium will begin to emerge. In Part III of this report, we noted changes in usage patterns as a result of learning; we also noted some of the component skills of communicating via PLANET, including typing, composing messages, reflecting on the messages, and editing and correcting spelling. Beyond these technical skills, users will need to learn new group skills, such as the organization and facilitation strategies noted in ISSUE AREA 4. They may also want to reorganize their use of time, deciding when to conference and for how long. They will need to make choices about substituting computer conferencing for other media, too. Some of these skills will come quickly, within the first hour of usage, for example. But other learning will be much slower, perhaps emerging only after two or more years.

Consider the development of patterns regarding the use of time. In Volume 3 of this series, we noted that 38 percent of all usage occurred outside of normal office hours.* This pattern was based on just a few users who were actively exploring the potential of computer conferencing as a new medium. Now, after 18 months of usage by a much larger group of people, we find that only 25.3 percent of usage occurs outside conventional office hours. This pattern may change again as terminals become more accessible or

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Group Communication Through Computers, Volume 3, Proposition 13, p. 134.

more portable, but for the current state of computer conferencing, it is probably a stable pattern.

Another consideration in the use of time is the *priority* given to various forms of communication. One participant in this study commented that he had always allocated his time as follows: face-to-face meetings first, phone calls when he was not in meetings, and letter correspondence only when no other communication was pressing. In terms of the ability to command attention, computer conferencing might have been given a priority comparable to letter writing. However, this user quickly realized that, in order to function effectively as a leader of a computer conference, he would have to reevaluate his priorities. Like most successful users, he eventually established a regular schedule for using PLANET, and arranged his other conferences to be compatible with that schedule.

One type of learning which may well exceed the time frame of this study is the development of strategies for complex communication tasks. As we observed earlier, PLANET was judged effective for tasks such as exchanging information or staying in touch but less so for tasks such as bargaining and persuasion. While these judgments certainly say something about the medium, it seems quite possible that the use of PLANET for bargaining, for example, simply requires a much longer learning period than for simple information exchange. In fact, as users become increasingly familiar with computer conferencing, it seems likely that a much wider variety of communication strategies will emerge. Our field tests illustrate some of the adaptations which computer conferencing demands, but some of the most creative uses may be yet to be discovered.

Although computer conferencing requires new skills and communication strategies, it also has the potential to "humanize" and augment computer technology for those who are not "computer professionals." For many scientists who have not used computers before, it could serve as a simple, yet useful introduction to other services, such as text editing, data-base retrieval, and modeling. At the USGS, several secretaries who had no previous computer experience began using the system without requiring extended training. In one instance, FORUM was demonstrated as an example of the future capabilities of computer technology for a class taught to geologists. It thus appears that conferencing can be an easy, effective step toward the use of more sophisticated computer tools.

ISSUE AREA 6
ORGANIZATIONAL ADAPTATION

Each organization must develop its own procedures for effective computer conferencing.

Just as individuals develop their own styles of conferencing through a learning process, organizations, too, must learn to use the medium effectively. In this report, we have noted a range of conferencing strategies for different organizations. NASA, for example, held conferences with a relatively large group of users over a period of many months, limiting the exchanges primarily to very technical data about schedules and project coordination. Kettering, on the other hand, managed a series of smaller, shorter conferences which dealt with a variety of conceptual issues. There is no single set of rules for effective computer conferencing; each organization must develop its own.

In particular, it seems likely that each organization will develop different strategies for dealing with the following kinds of decisions:

- Budgeting. The costs of computer conferencing can be charged in different ways. A conferencing budget may be established for each individual project, with the cost of terminals, computer usage, and support services charged to the project. Or all computer conferencing expenses may be viewed as part of general overhead, much like the telephone and letter correspondence are in many organizations. Of course, a halfway approach is possible, too: the cost of terminals, for example, may be charged to overhead while the computer usage costs must be covered by individual project budgets.
- Training and Facilitation. In our field tests, we have observed three different patterns of training and facilitation. For several conferences, the organizers depended on Institute staff to do all

training and facilitation. In other cases, new users were added without our knowledge at all, and we assume that various members of the organization provided some basic training, if not facilitation. We feel that training is a critical factor in the success of computer conferences and suspect that it will take each organization time to develop effective training and facilitation procedures for its staff and clients. We also suspect that failure to address training and facilitation issues directly will lead to a haphazard user base and, perhaps as a result, some organizational conflict.

- Applications. These field tests have demonstrated a wide variety of applications for computer conferencing within the research community, and these applications are closely linked to the way in which the medium is used by any given organization. The Kettering Foundation, for example, has a relatively small staff but a commitment to bringing together diverse individuals from a variety of institutions to address various social and technical problems. It is not surprising, then, that this group used computer conferencing a lot for topical conferences among nonstaffers but very little for internal communication. At the Institute for the Future, we also have a small staff, but we developed a different set of applications. We used the medium both for internal project management, often including one outside group, such as the project sponsor or a consultant or a group doing parallel research. As might be expected, some of the larger user groups, such as NASA and USGS, focused more on the coordinating potential of the medium, emphasizing a "notepad" style of usage. Beyond size and mission, organizational procedures will probably be influenced by differing needs for secrecy, differences in divisions of responsibility, and differences in internal resources, such as libraries, data bases, and staff expertise.

- Technical Options. Finally, each organization will need to decide on the best strategies for using the technical options in computer conferencing. The most notable example of this type of choice is the use of private messages. As mentioned earlier, many organizations discouraged their users from sending private messages, emphasizing the use of the telephone for such "social" communication. Some groups, such as the National Library of Medicine went further; they simply forbade the use of private messages. PLANET allows the organizer of a conference to "turn off" private messages, and even groups which normally used the private mode occasionally employed this feature, particularly during synchronous meetings. On the other hand, some groups deliberately instructed various subgroups to use private messages for a period of time. Such technical choices may be more *task* effective, but organizations will have to be sensitive to their *social* implications.

ISSUE AREA 7

MANAGEMENT SUPPORT

Computer conferencing can support many management activities, but it will not automatically eliminate organizational barriers to communication.

The conferences examined in this report have demonstrated that computer conferencing can effectively support a wide range of managerial tasks. For example, the use of PLANET to organize and follow-up the international COGEODATA conference in Paris (see page 18) demonstrated that logistical arrangements and administrative details could be handled expeditiously over the system; entire groups or subgroups could be kept informed of schedule changes or new appointments. Furthermore, the medium allowed the group to continue work left unfinished at the close of the face-to-face meeting.

Similarly, the NASA CTS conference (page 36) demonstrated the use of PLANET to help administer a widely disseminated group with timeliness and precision. Often, demands for timeliness made PLANET an attractive substitute for other media, as illustrated by this exchange between geologists:

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[114] Bie  25-Feb-76  5:01 AM  (in the Netherlands)
Gentlemen, I found a letter from Richard Howarth waiting for me on
my return from the U.S.  The postal services had not been too kind to
the parcel with GRASP I sent to him.  I have tried repeatedly to
catch him on the telephone, but he is not in his office. -- Roger,
has our GRASP parcel now arrived in USGS (sent 9 Feb. from here)?

[114] Bowen (Org)  25-Feb-76  5:05 AM  (in Washington, DC)
Stein, re 114, no.  It is still in never-never land somewhere.  I
think we need the capability of sending data in computer-readable
form using PLANET.  This mail stuff is a pain in the neck.  I'll let
you know as soon as it arrives.
```

The geologists also used computer conferencing for sharing, supporting, and supplementing data bases. The sharing of data bases presents a number of problems. First, many data bases are machine-dependent: one must access a particular computer in order to use them. In addition, they are typically combersome to interrogate due to the complexity of retrieval languages. Finally, there is no consistency in file structures across systems and little information on data availability and validation. Computer conferencing is clearly not a simple answer to these complex issues, but it has been used to keep data-base users and designers in closer contact, to promote standardization, and to raise issues about the bias and validity of data. For example, consider the following dialogue between Askevold and a user in Denmark:

> [200] Platou 11-Nov-75 1:36 PM
> A comment to the file test problems--I think it must be very difficult to ask questions to other people's files without knowing rather exactly how they were created, philosophy and principles, and knowing something about how safe the data are with respect to quality and so on. My doubts originate from the problems we have here with our own files.
>
> [204] Askevold (Org) 11-Nov-75 3:58 PM
> I would have to say our experience to date confirms what you say, but perhaps one of the major advantages in attempting to ask some questions is to find out what these data bases can't answer as well as what they can answer, and to figure out what it will take to make them usable to other people.

In general, it seems likely that computer conferencing could be used to keep groups of workers informed of changing resources. Catalogs, bulletins, inventories require constant updating and reprinting: effective use of a system like PLANET might save some of this expense. Also, such a system could facilitate the implementation, documentation, and dissemination of software tools. It could be especially useful in advertising, maintaining, and assisting in the use of information centers or any activity which is *dynamic* in nature, especially when the intended users are widely disseminated.

Other managerial applications of computer conferencing include raising policy issues and monitoring positions on issues, maintaining communication while away from a central office, and opening new channels for dissemination of information. However, many of these managerial problems will not respond to a technical solution; they require organizational change. For example, computer conferencing could reduce the need for increasingly scarce and expensive office space; it could promote more job satisfaction for workers who prefer to have a more flexible schedule or work at a distance. But such "office decentralization" would pose a threat to traditional managers who are likely to feel a loss of control over subordinates. It could increase the difficulty in assessing employee productivity and motivation.

The use of computer conferencing does not automatically promote sharing and cooperation; it does not automatically eliminate organizational barriers. The extended use of computer conferencing by the U.S. Geological Survey did *not* lead to widespread development of computer conferencing in the geoscience community. Granted, two years may be long enough to ascertain the utility of the concept but not sufficient to establish it as a permanent communication tool. However, we can identify several factors that have tended to reduce organizational acceptance of the medium. These factors differ in the case of PLANET and FORUM.

For PLANET, the cost of the system was an important consideration. The Survey is continuing to use the system on a commercial network, but a significant reduction in computer charges will be necessary before usage can expand substantially.

In the case of FORUM, the Survey owned the computer on which the program was running. While the economics of this arrangement should have encouraged internal use by many groups, it had the opposite effect of limiting access to geologists in Denver and their immediate correspondents in related projects at other sites. The reasons for these restrictions were organizational:

- The Denver computer was operated by a group of EDP professionals who were concerned about minimizing the load on their machine. They *discouraged use of the computer* by other USGS sites as a matter of policy since the other sites had access to their own computer resources. This concern with minimizing outside usage ran contrary to the hope, represented by FORUM, of expanding communications across organizational barriers.

- The Denver computer facility could not be accessed through the federal phone system (FTS). This decision was deliberate and in keeping with the policy mentioned above.

- There was an initial resentment of computer conferencing among the EDP personnel. This attitude changed when some of the managers began using FORUM in their own work, but the system was always viewed as an intrusion upon "normal" computer activity. FORUM is not like a compiler, an assembler, a graphics package, or a typical application program. Hence, the professional incentive for systems programmers to become faciliar with conferencing is fairly low and is not viewed as a career-enhancing activity.

- The use of FORUM was initially viewed as something that was requested "by Washington." This view created an additional organizational barrier until local managers began to use the system actively.

It is unlikely that computer conferencing will dissolve communication barriers. Rather, it will probably reveal "latent" communication patterns. These latent patterns may be positive--consider the emergence of invisible colleges--or they may be negative, revealing disharmony, rivalry, and potential feuds. In this sense, computer conferencing might act as a mirror of *actual*, as opposed to *theoretical*, power structures within an organization.

ISSUE AREA 8

COMPUTER CONFERENCING AS A FORM OF GROUP COMMUNICATION

While computer conferencing via PLANET has some of the same features as other computer-based services, such as electronic mail, it is a distinct form of communication with its own set of effects on personal as well as organizational patterns of communication.

Many users of PLANET have commented on the similarities between computer conferencing and computer mail. In fact, some people feel that there is no fundamental difference at all and that "conferencing" is simply a poor term for the kind of communication which occurs via this system. While we do not wish to engage in a semantic debate, we do feel that there are some important differences between computer conferencing and computer mail.

Like FORUM or PLANET, a computer mail system enables users to send and receive messages. However, these messages are not classified by topics, do not constitute a continuous, retrievable record of an issue area, and cannot be exchanged in synchronous mode among an entire group. Therefore, most of the patterns of use we have observed earlier would not have been found under a mailbox system.

One PLANET user made the following observation:

> I have used computer mail to perform many [tasks] satisfactorily. I'm not sure what distinction you make when you say "conferencing." The problem really is how creatively are you using the medium, not the medium itself.

In looking at how people have used PLANET during these field tests, we must conclude that the system is essentially a medium for *small group communication*. The most successful conferences have generally been those in which the participants came to see themselves as a team rather than isolated representatives of various organizations or divisions. The process by which such "team spirit" evolved is not completely clear, but it seems likely that the ability to meet "synchronously" as a group and to exchange both public and private messages is important. We have noted that private messages were often used for social communication rather than task-related communication; it's not surprising that this kind of communication was high initially as the group established itself, giving way later to public, task-related discussion. Both phases seem necessary for the development of a group. The synchronous feature was also important to the development of a group identity. In the concluding sessions of the Kettering conference on Individually Guided Education, the organizer made the following entry:

> [326] Simmons (Org) 14-Oct-76 4:09 PM
> The high point of my 16 weeks of conference has been the day we had the "miniconference" on planning clinical workshops. That one time we had just about everyone "online" and the interaction was good. It lasted for two hours and in that section of the transcript you can see the same dynamics that you would in a face-to-face conference! It made me realize the value of this type of communication . . . . It also made being part of the IGE group very rewarding to me.

Another feature of the conferences which we have observed is *preplanning*. As indicated in ISSUE AREA 3, preplanning is one of the crucial factors in a successful computer conference. Conferences have focus and direction; they may continue over long periods of time, but participants periodically reevaluate their direction and make social choices about their organization: whether to hold "miniconferences" or create new conferences or use only the public mode. Such choices indicate a perception of the communication process which is fundamentally different from perceptions of mail. It is not point-to-point communication; it is *group communication* and should be treated as such, both in the technical organization of the use of the medium and in the analysis of its effects.

APPENDIX A

USAGE AND COST DATA
OCTOBER 1974 TO MARCH 1977

Participant = user in an activity

	Oct. 1974	Nov. 1974	Dec. 1974	Jan. 1975	Feb. 1975	Mar. 1975	Subtotal 6 months
USAGE							
User accounts	2	3	5	5	5	8	8
Activities (conferences)	3	17	19	11	22	38	110
Sessions (jobs)	13	69	201	450	375	634	1,742
Participants	8	14	26	20	33	62	--
Usage time (minutes)	165	714	2,349	3,927	4,783	8,689	20,627
Usage time (Hr-Min)	2H45	11H54	39H09	65H27	79H43	144H49	343H47
Messages - Public	30	115	362	465	679	808	2,459
- Private	11	21	113	252	159	468	1,024
- Total	41	136	475	717	838	1,276	3,483
Characters - Public	9,200	30,175	87,870	131,365	136,060	234,565	629,235
- Private	1,185	3,100	17,215	54,610	27,095	89,595	192,800
- Total	10,385	33,275	105,085	185,975	163,155	324,160	822,035
PLANET cost ($):							
Development project	57	214	437	610	151	317	1,786
Other accounts	0	63	300	460	890	1,960	3,673
Total usage	57	277	737	1,070	1,041	2,277	5,459
Percentage outside use	0%	23%	41%	43%	85%	86%	67%
COST							
Cost per hour ($)	20.73	23.28	18.82	16.34	13.05	15.72	15.88
Cost per minute ($)	0.35	0.39	0.31	0.27	0.21	0.26	0.26
Cost per 20 words (= 100 char.)	0.72	0.77	0.70	0.56	0.64	0.70	0.66
Cost per message ($)	1.39	2.04	1.55	1.49	1.24	1.78	1.57
Cost per activity	19.00	16.29	38.79	97.27	47.32	59.92	49.63
Cost per session	4.38	4.01	3.67	2.38	2.78	3.59	3.13
Cost per participant	7.12	19.78	28.35	53.5	31.5	35.0	
Time per activity (min.)	55.0	42.0	123.6	357.0	217.4	228.7	187.5
Time per session (min.)	12.6	10.3	11.6	8.2	12.8	13.7	11.8
Time per participant (min.)	20.6	51.0	90.3	196.3	145.0	140.0	--
Storage blocks--development	74	97	151	121	171	218	--
Storage cost--development ($)	24	31	48	39	55	70	267
Private/public messages	0.35	0.18	0.31	0.54	0.23	0.58	0.42
Message length - Public	307	262	243	282	200	290	255
- Private	108	148	152	217	170	191	188
- Overall	253	245	221	259	195	254	236
Characters/minute	63	46	45	47	34	37	40

Participant = user in an activity

	Apr. 1975	May 1975*	June 1975	July 1975	Aug. 1975	Sep. 1975	Subtotal 6 months
USAGE							
User accounts	7	6	9	7	9	8	11
Activities (conferences)	31	26	32	29	32	29	179
Sessions (jobs)	721	675	954	756	669	656	4,431
Participants	39	38	51	48	45	51	--
Usage time (minutes)	4,474	6,279	14,728	9,743	6,950	4,497	46,671
Usage time (Hr-Min)	74H34	104H39	245H28	162H23	115H50	74H57	777H51
Messages - Public	565	714	1,842	1,112	735	414	5,382
- Private	269	622	1,429	956	704	403	4,383
- Total	834	1,336	3,271	2,068	1,439	817	9,765
Characters - Public	166,920	164,190	471,560	272,845	195,320	108,740	1,379,575
- Private	39,610	94,820	249,950	209,575	139,825	81,030	814,810
- Total	206,530	259,010	721,510	482,420	335,145	189,770	2,194,385
PLANET cost ($):							
Development project	535	583	328	1,110	1,718	753	5,027
Other accounts	635	1,083	3,407	1,509	228	420	7,282
Total usage	1,170	1,666	3,735	2,619	1,946	1,173	12,309
Percentage outside use	54%	65%	91%	58%	12%	36%	59%
COST							
Cost per hour ($)	15.70	15.90	15.20	16.13	16.80	15.65	15.78
Cost per minute ($)	0.26	0.26	0.25	0.27	0.28	0.26	0.26
Cost per 20 words (= 100 char.)	0.57	0.64	0.52	0.54	0.58	0.62	0.56
Cost per message ($)	1.40	1.25	1.15	1.27	1.35	1.44	1.26
Cost per activity	37.74	64.08	116.72	90.03	60.81	40.45	68.77
Cost per session	1.62	2.47	3.95	3.46	2.91	1.79	2.78
Cost per participant	30.0	43.8	73.94	54.56	43.24	23.00	--
Time per activity (min.)	144.3	241.5	460.25	335.97	217.19	155.07	260.73
Time per session (min.)	6.20	9.3	15.43	12.9	10.4	6.86	10.53
Time per participant (min.)	114.7	165.2	288.78	202.98	154.44	88.18	--
Storage blocks--development							
Storage cost--development							
Private/public messages	0.48	0.87	0.78	0.86	0.96	0.97	0.81
Message length - Public	295	230	256	245	266	263	256
- Private	147	152	175	219	199	201	186
- Overall	248	194	221	233	233	232	225
Characters/minute	46	41	49	50	48	42	47

*One week missing

Participant = user in an activity

	Oct. 1975	Nov. 1975*	Dec. 1975	Jan. 1976	Feb. 1976	Mar. 1976	Subtotal 6 months
USAGE							
User accounts	10	10	11	11	13	12	13
Activities	35	36	37	34	40	33	215
Sessions	1,525	2,161	1,878	2,281	1,953	1,473	11,271
Participants	87	89	91	97	109	94	--
Usage time (min.)	12,202	15,571	11,956	16,219	14,921	8,399	79,268
Usage time (Hr-Min)	203H22	259H31	199H16	270H19	248H41	139H59	1321H08
Messages - Public	822	1,302	823	1,297	1,260	807	6,311
- Private	1,183	1,208	838	864	856	456	5,405
- Total	2,005	2,510	1,661	2,161	2,116	1,263	11,716
Characters - Public	203,120	339,170	280,665	476,000	473,715	294,860	2,067,530
- Private	220,575	247,005	191,480	176,365	208,460	164,625	1,208,510
- Total	423,695	586,175	472,145	652,365	682,175	459,485	3,276,040
PLANET cost ($):							
Development project	715	485	314	255	744	863	3,376
Other accounts	2,647	4,078	2,967	4,283	3,416	1,581	18,972
Total usage	3,363	4,563	3,281	4,538	4,160	2,444	22,348
Percentage outside use	79%	89%	90%	94%	82%	65%	85%
COST							
Cost per hour ($)	16.54	17.58	16.47	16.79	16.73	17.45	16.92
Cost per minute ($)	0.28	0.29	0.27	0.28	0.28	0.29	0.28
Cost per 20 words (= 100 char.)	0.79	0.78	0.69	0.70	0.61	0.53	0.68
Cost per message	1.68	1.82	1.98	2.10	1.97	1.94	1.91
Cost per activity	96.09	126.75	88.68	133.47	104.00	74.06	103.94
Cost per session	2.21	2.11	1.75	1.99	2.13	1.66	1.98
Cost per participant	38.66	51.27	36.05	46.78	38.17	26.00	--
Time per activity (min.)	348.63	432.53	323.14	477.03	373.03	254.52	368.69
Time per session (min.)	8.00	7.21	6.37	7.11	7.64	5.70	7.03
Time per participant (min.)	140.03	175.96	131.38	167.21	136.89	89.35	--
Storage blocks--development							
Storage cost--development ($)							
Private/public messages	1.44	0.93	1.02	0.67	0.68	0.57	0.86
Message length - Public	247	260	341	367	376	365	328
- Private	186	204	228	204	244	361	224
- Overall	211	234	284	302	322	364	280
Characters/minute	35	38	39	40	46	55	41

*Tymshare rate increase 12¢ per TRU.

Participant = user in an activity

	1976 April	May	June	July	August	September	Subtotal 6 Months
USAGE							
User accounts	11	10	11	10	10	11	11
Activities	41	45	45	58	46	30	265
Sessions	1,650	2,166	2,063	2,212	1,696	1,404	11,191
Participants	92	98	105	96	94	93	--
Usage time (minutes)	10,950	14,483	15,670	15,563	14,674	11,450	82,790
Usage time (hours-minutes)	182h30m	241h23m	261h10m	259h23m	244h34m	190h50m	1,379h50m
Messages - Public	1,106	1,148	1,680	1,276	1,418	992	7,620
- Private	760	954	1,161	1,130	1,143	634	5,782
- Total	1,866	2,102	2,841	2,406	2,561	1,626	13,402
Characters - Public	291,435	344,530	462,570	413,095	470,295	382,345	2,364,270
- Private	190,380	227,190	243,845	273,775	255,820	208,755	1,399,765
- Total	481,815	571,720	706,415	686,870	726,115	591,100	3,764,035
PLANET costs ($):							
Development project	665	663	567	331	267	245	2,738
Other accounts	2,335	3,322	3,706	3,988	3,769	2,883	20,003
Total usage	3,000	3,985	4,273	4,319	4,036	3,128	22,741
Percentage outside use	78%	83%	87%	92%	93%	92%	88%
COST							
Cost per hour ($)	16.44	16.51	16.36	16.65	16.50	16.39	16.48
Cost per minute	0.27	0.28	0.27	0.28	0.28	0.27	0.27
Cost per 20 words (= 100 char.)	0.62	0.70	0.60	0.63	0.56	0.53	0.60
Cost per message	1.61	1.90	1.50	1.80	1.58	1.92	1.70
Cost per activity	73.17	88.56	94.96	74.47	87.74	104.27	85.82
Cost per session	1,82	1.84	2.07	1.95	2.38	2.23	2.03
Cost per participant	32.61	40.66	40.70	44.99	42.94	33.63	--
Time per activity (minutes)	267.07	321.84	348.22	268.33	319.00	381.67	312.42
Time per session (minutes)	6.64	6.69	7.60	7.04	8.65	8.16	7.40
Time per participant (minutes)	119.02	147.79	149.24	162.11	156.11	123.12	--
Storage blocks - Development							
Storage cost - Development ($)							
Private/public messages	0.69	0.83	0.69	0.89	0.81	0.64	0.76
Message length (char.) - Public	264	300	275	324	332	385	310
- Private	251	238	210	242	224	329	242
- Overall	258	272	249	285	284	363	281
Characters/minute	44	39	45	44	50	52	45

Participant = user in an activity

	Oct. 1976	Nov. 1976	Dec. 1976	Jan. 1977	Feb. 1977	Mar. 1977	Subtotal 6 months
USAGE							
User accounts	11	10	10	9	10	9	11
Activities	29	34	38	26	27	21	154
Sessions	976	965	1,846	1,498	1,208	1,223	7,716
Participants	85						
Usage time (minutes)	6,253	5,112	10,542	8,469	5,898	6,227	42,501
Usage time (Hr-Min)	104H13	85H12	175H42	141H09	98H18	103H47	708H21
Messages - Public	559	462	496	515	377	330	2,739
- Private	349	331	290	322	267	481	2,040
- Total	908	793	786	837	644	811	4,779
Characters - Public	208,105	135,815	311,950	248,645	163,400	115,425	1,183,340
- Private	112,705	96,265	76,370	105,255	81,895	141,350	613,840
- Total	320,810	232,080	388,320	353,900	245,295	256,775	1,797,180
PLANET cost ($):							
Development project	0	0	0	0	0	0	0
Other accounts	1,759	1,399	3,048	2,341	1,673	1,784	12,004
Total usage	1,759	1,399	3,048	2,341	1,673	1,784	12,004
Percentage outside use	100%	100%	100%	100%	100%	100%	100%
COST							
Cost per hour ($)	16.88	16.42	17.34	16.59	17.02	17.19	16.95
Cost per minute ($)	0.28	0.27	0.29	0.28	0.28	0.27	0.28
Cost per 20 words (= 100 char.)	0.55	0.60	0.78	0.66	0.68	0.69	0.67
Cost per message ($)	1.94	1.76	3.88	2.80	2.60	2.20	2.51
Cost per activity ($)	60.65	41.15	80.21	90.04	61.96	84.95	77.95
Cost per session ($)	1.80	1.45	1.65	1.56	1.38	1.48	1.56
Cost per participant ($)							
Time per activity (min.)	215.62	150.35	277.42	32[illegible].73	218.44	296.52	275.98
Time per session (min.)	6.41	5.30	5.71	5.65	4.88	5.09	5.51
Time per participant (min.)							
Storage blocks--development							
Storage cost--development ($)							
Storage/PLANET--development							
Total cost--development ($)							
Development--total usage							
Private/public messages	0.62	0.72	0.58	0.63	0.71	1.46	0.74
Message length - Public	372	294	629	483	433	350	432
- Private	323	291	263	327	307	315	301
- Overall	353	293	494	423	381	317	376
Characters/minute	51	45	37	42	42	41	42

Participant = user in an activity

	Total	Total	Subtotal	Grand total
	Oct. 74-Sep. 75	Oct. 75-Sep. 76	Oct. 76-Mar. 77	Oct. 74-Mar. 77
USAGE				
User accounts	11	13	11	
Activities	289	480	154	923
Sessions	6,173	22,462	7,716	37,120
Participants				
Usage time (minutes)	67,298	162,058	42,501	271,857
Usage time (Hr-Min)	1121H38	2701H00	708H21	4530H57
Messages - Public	7,841	13,931	2,739	24,511
- Private	5,407	11,187	2,040	18,634
- Total	13,248	25,118	4,779	43,145
Characters - Public	2,008,810	4,431,800	1,183,340	7,623,950
- Private	1,007,610	2,608,275	613,840	4,229,725
- Total	3,016,420	7,040,075	1,797,180	11,853,675
PLANET cost ($):				
Development project	6,813	6,114	0	12,927
Other accounts	10,955	38,975	12,004	61,934
Total usage	17,768	45,089	12,004	74,861
Percentage outside use	62%	86%	100%	83%
COST				
Cost per hour ($)	15.84	16.69	16.95	16.50
Cost per minute ($)	0.26	0.28	0.28	0.28
Cost per 20 words (= 100 char.)	0.59	0.64	0.67	0.63
Cost per message ($)	1.34	1.80	2.51	1.74
Cost per activity ($)	61.48	93.94	77.95	81.11
Cost per session ($)	2.88	2.01	1.56	2.02
Cost per participant ($)				
Time per activity (min.)	232.87	337.62	275.98	294.54
Time per session (min.)	10.90	7.21	5.51	7.32
Time per participant (min.)				
Storage blocks--development				
Storage cost--development ($)				
Storage/PLANET--development				
Total cost--development ($)				
Development--total usage				
Private/public messages	0.69	0.80	0.74	0.76
Message length - Public	256	318	432	311
- Private	186	233	301	227
- Overall	228	280	376	275
Characters/minute	45	43	42	44

APPENDIX B

SUMMARY OF QUESTIONNAIRE RESPONSES

INSTITUTE FOR THE FUTURE
2740 Sand Hill Road Menlo Park CA 94025 (415) 854-6322

In the past year, you have gotten to know something about computer conferencing. We're trying to learn from your experience. So we're asking all of the users of the Institute's computer conferencing system to answer a few questions for us. It shouldn't take long--not more than five minutes.

These are things we would like to know:

Did you do your own typing?

Yes 104 No 12

How would you rate your typing ability (or that of the person who typed for you)?

Very Poor	Poor	Adequate	Good	Very Good
4	11	52	36	14

How much previous experience, if any, have you had using computers?

Much		Some		None
39	7	22	15	31

and . . . .

How strong was your motivation to participate in the conference(s)?

Very strong				Very Weak
48	37	19	7	1

Thinking back over your experience with computer conferencing, how frequently did you feel . . . .

	Always	Almost Always	Sometimes	Almost Never	Never
distracted by the mechanics of the conferencing system?	1	10	43	47	15
constrained in the types of contributions you could make?	1	10	43	38	23
overloaded with information?	4	7	51	28	25
able to express your views?	37	52	22	3	1
able to get an impression of personal contact with other participants in the conference?	15	44	31	17	5

In what ways has computer conferencing been especially successful for you?

61	It worked well for information exchange.
66	I could keep in touch with others.
41	I could participate at my convenience.
38	A written record was easily available.
20	I enjoyed using it.
46	Other (Please specify: e.g. new communications experience, saved time, inexpensive)

In what ways has it been especially unsuccessful for you?

31 I had computer problems. (Explain: ____________________)

29 Group members participated irregularly.

22 Discussions lacked focus.

16 There was not enough interaction among participants.

12 It took too much time.

8 It was hard to get to a terminal.

44 Other (Please specify: e.g. conference too short, information overload, participants not prepared well, poor medium to task matchup, too expensive, have to type)

How satisfactory do you think computer conferencing would be for the following activities?

	Completely Unsatisfactory						Completely Satisfactory
Giving or receiving information	0	0	1	6	29	41	38
Problem solving	2	5	19	22	28	25	7
Bargaining	3	19	25	24	18	12	4
Decision-making	0	12	17	26	21	26	5
Generating ideas	0	3	5	20	19	43	22
Persuasion	2	28	35	20	15	8	2
Asking questions	0	1	3	8	13	45	43
Resolving disagreements	1	27	24	23	23	7	4
Getting to know someone	10	21	20	31	22	5	3
Giving or receiving orders	1	1	7	14	17	38	30
Maintaining friendly relations ("staying in touch")	1	2	7	17	21	41	23
Exchanging opinions	0	0	1	13	23	39	36
Other (What? . . . .)							

PAGE(S) 185-195, Appendix C WAS (WERE) MISSING (REMOVED) FROM THIS DOCUMENT PRIOR TO ITS BEING SUBMITTED TO THE ERIC DOCUMENT REPRODUCTION SERVICE

APPENDIX D

INSTITUTE PUBLICATIONS ON COMPUTER CONFERENCING

MAJOR REPORTS

Group Communication through Computers,

Volume 1: Design and Use of the FORUM System, Jacques Vallee, Hubert Lipinski, and Richard H. Miller, Report R-32, July 1974.

Volume 2: A Study of Social Effects; Jacques Vallee; Robert Johansen; Robert H. Randolph, Consultant; and Arthur C. Hastings, Consultant; Report R-33; November 1974.

Volume 3: Pragmatics and Dynamics; Jacques Vallee; Robert Johansen; Hubert Lipinski; Kathleen Spangler; Thaddeus Wilson; and Andrew Hardy, Consultant; Report R-35; October 1975.

Volume 4: Social, Managerial, and Economic Issues, Jacques Vallee, Robert Johansen, Hubert Lipinski, and Thaddeus Wilson, forthcoming.

GENERAL DESCRIPTIONS OF THE COMPUTER CONFERENCING MEDIUM

The Outlook for Computer Conferencing on ARPANET and PLATO
Jacques Vallee, prepared for the Society for General Systems Research Meeting, February 1977.

"Pragmatics and Dynamics of Computer Conferencing: A Summary of Findings from the FORUM Project"
Jacques Vallee, Robert Johansen, Hubert Lipinski, and Thaddeus Wilson; in *Proceedings of the Third International Conference on Computer Communication,* August 1976; Paper P-42. (This paper is a summary of *Group Communication through Computers, Volume 3.*)

"The FORUM Project: Network Conferencing and Its Future Applications"
Jacques Vallee; in *Computer Networks,* vol. 1, 1976; Paper P-41.

"The Computer Conference: An Altered State of Communication?"
Jacques Vallee, Robert Johansen, and Kathleen Spangler; in *The Futurist,* vol. 9, no. 3, June 1975; Paper P-33.

"Talking through Your Computer"
Sydney Paulden, in *Financial Times*, January 27, 1975.

"FORUM: A Computer-Based System to Support Interaction among People"
Roy Amara and Jacques Vallee; in *Proceedings of the International Federation of Information Processing Congress*, August 1974; Paper P-39.

"Network Conferencing"
Jacques Vallee; in *Datamation*, May 1974; Paper P-28.

SOCIAL EVALUATION OF TELECONFERENCING MEDIA

Learning the Limits of Teleconferencing
Robert Johansen, Jacques Vallee, and Kent Collins, submitted to NATO Symposium on the Evaluation and Planning of Telecommunications Systems, University of Bergamo, Italy, September 5-8, 1977.

Computer Conferencing: Measurable Effects on Working Patterns
Robert Johansen, Jacques Vallee, and Michael Palmer; prepared for the National Telecommunication Conference of the Institute of Electrical and Electronics Engineers, November 29-December 1, 1976, Dallas, Texas; Paper P-44.

Impact of a Computer-Based Communications Network on the Working Patterns of Researchers
Robert Johansen and Jacques Vallee; presented at the American Sociological Association Annual Meeting, August 1976; Paper P-46.

Pitfalls in the Social Evaluation of Teleconferencing Media
Robert Johansen; presented at the Second Annual International Communications Conference, University of Wisconsin-Extension, May 27-28, 1976; Paper P-38.

Developing New Communications Media: Can We Account for the Human Dimensions?
Robert Johansen, presented at the World Future Society Second General Assembly, June 2, 1975.

"Group Communication through Electronic Media: Fundamental Choices and Social Effects"
Robert Johansen, Richard H. Miller, and Jacques Vallee; in *Educational Technology*, vol. 14, no. 8, August 1974; Paper P-27.

Social Assessment of Mediated Group Communication: A Workshop Summary
Institute for the Future, March 1974.

Commentary on One Use of FORUM in a Research Environment
Robert Johansen and Richard H. Miller, September 1973.

DESIGN AND DEVELOPMENT

"Modeling as a Communication Process: Computer Conferencing Offers New Perspectives"
Jacques Vallee; in *Technological Forecasting and Social Change*, vol. 10, no. 4, forthcoming; Paper P-52.

There Ain't No User Science
Jacques Vallee, prepared for the American Society for Information Science Conference, October 1976.

"Conferencing in an On-Line Environment: Some Problems and Possible Solutions"
Hubert Lipinski and Robert H. Randolph; in *Proceedings of the Second Annual Computer Communications Conference*, San Jose, 1973.

"FORUM: A Computer-Assisted Communications Medium"
Hubert Lipinski and Richard H. Miller; in *Computer Communication Today and Up to 1985*, The Second International Conference on Computer Communication, Stockholm, August 12-14, 1974; Paper P-26.

"Computer-Assisted Expert Interrogation, A Report on Current Methods Development"
Andrew Lipinski, Hubert Lipinski, and Robert H. Randolph; in Stanley Winkler, ed., *Computer Communications: Impacts and Implications*, The First International Conference on Computer Communication, Washington, D.C., October 24-26, 1972; Paper P-24.

APPLICATIONS OF COMPUTER CONFERENCING

Computer Conferencing in the Geosciences
Jacques Vallee, Gerald Askevold, and Thaddeus Wilson, Final Report to the U.S. Geological Survey, forthcoming.

"Distributed Management of Scientific Projects"
Jacques Vallee and Bradford Gibbs; in *Telecommunications Policy*, December 1976; Paper P-47.

"Remote Viewing Experiments through Computer Conferencing"
Jacques Vallee, Arthur C. Hastings, and Gerald Askevold; in *Proceedings of the Institute of Electrical and Electronics Engineers*, October 1976; Paper P-49.

Computer-Based Communication in Support of Scientific and Technical Work
Jacques Vallee and Thaddeus Wilson, Final Report to the National Aeronautics and Space Administration, March 1976.

"Computer Networks and the Interactive Use of Geologic Data: Recent Experiments in Teleconferencing"
Jacques Vallee and Thaddeus Wilson; in *Proceedings of the COGEODATA Symposium,* Paris, November 24-26, 1975; reprinted in *Computers and Geosciences,* in press; Paper P-45.

"Geologic Applications of Network Conferencing: Current Experiments with the FORUM System"
Jacques Vallee and Gerald Askevold; in *Proceedings of the Annual Meeting of the American Chemical Society,* August 1975; reprinted in Peter Lykos, ed., *Computer Networking and Chemistry,* American Chemical Society Symposium Series #19, Washington, D.C., 1975; Paper P-34.

"Computer Conferencing"
Jacques Vallee, Hubert Lipinski, Robert Johansen, and Thaddeus Wilson, letter to the editor, *Science,* April 18, 1975.

Teleconference on Integrated Data Bases in Postsecondary Education
A transcript and summary, published jointly by Lilly Endowment, Inc., and the Institute for the Future, March 10-14, 1975.

"Human Responses to Sulfur Pollutants"
Samuel C. Morris and M. Granger Morgan, eds., *Proceedings of a Conference of the Biomedical and Environmental Assessment Group,* Brookhaven National Laboratory, BNL 20328, September-November 1974 (available from the National Technical Information Service).

Travel/Communications Relationships
James Kollen and Jacques Vallee, eds., a computer conference transcript, July 1974 (available from Bell Canada, Business Planning Group).

INTERNAL TECHNICAL MEMORANDA

"Negotiation and Integration Behavior in Computer Conferencing: Experimental Simulation of an International Conference on the FORUM-5 System (Conferences C12 and C13)"
Andrew Hardy and Thaddeus Wilson, December 1974, ITM-70.

"Evaluation of Off-Campus Experiential Learning: Transcript and Analysis of Experimental Conference C19 Using the FORUM-6 System "
Thaddeus Wilson, November 1974, ITM-71

"The Freeway Game: Transcript and Analysis of Experimental Conference C25"
Jacques Vallee, Robert Johansen, Hubert Lipinski, and Thaddeus Wilson, November 1974, ITM-72

"CRISIS-1: A Social Simulation Using Synchronous Conferencing (Conference C27)"
Jacques Vallee, Robert Johansen, Hubert Lipinski, Thaddeus Wilson, November 1974, ITM-73.

"CRISIS-2: A Social Simulation Using Synchronous Conferencing (Conference C28)"
Jacques Vallee, Robert Johansen, Hubert Lipinski, Thaddeus Wilson, December 1974, ITM-74.

"The Effects of Exposure to Sulfur Pollutants: Computer Conference C18 Using the FORUM-6 System"
Jacques Vallee, Robert Johansen, Hubert Lipinski, Thaddeus Wilson, December 1974, ITM-75.

"Two International Computer Conferences Using the PLANET-1 System on the Tymshare Network (Conferences T1 and T2)"
Jacques Vallee, Thaddeus Wilson, and Hubert Lipinski, December 1974, ITM-76.

"Teleconference on Integrated Data Bases in Postsecondary Education Using the PLANET-1 System"
Robert Johansen and John Ferguson, April 1975, ITM-77.

"CRISIS-3: A Social Simulation Using Synchronous Conferencing (Experiment T9)"
Jacques Vallee, Robert Johansen, Hubert Lipinski, Thaddeus Wilson, May 1975, ITM-78.

"Transcript and Analysis of Current Issues in Psychic Research: An International Computer Conference (Experiment T11)"
Jacques Vallee, Thaddeus Wilson, and Arthur Hastings, July 1975, ITM-79.

"Transcripts of Experimental Conferences Conducted under PLANET-1 (First Year)"
Jacques Vallee and Thaddeus Wilson, October 1975, ITM-80.

"Monitor Statistics for the First Year of PLANET-1 Operation"
Thaddeus Wilson and Hubert Lipinski, October 1975, ITM-81.

"Observations of Five Conferences in Three Communications Media"
Jacques Vallee and Thaddeus Wilson, February 1976, ITM-82.

"The Design of Social Research to Evaluate a Person-to-Person Medium of Communication"
Robert Johansen and Richard H. Miller, January 1974, ITM-83.

"TCA Results - Section A: Analysis of PLANET-1 Monitor Statistics from July 1975 to June 1976"
Hubert Lipinski, October 1976, ITM-84.

"TCA Results - Section B: Analysis of PLANET-1 Monitor Statistics for USGS Users, October 1975 to June 1976"
    Hubert Lipinski, October 1976, ITM-85.

"TCA Results - Section C: Analysis of FORUM Monitor Statistics for USGS Users, September 1975 to June 1976"
    Hubert Lipinski, October 1976, ITM-86.

"TCA Results - Section D: Analysis of PLANET-1 Computer Sessions from July 1975 to June 1976"
    Hubert Lipinski, October 1976, ITM-87.

"PLANET User Statistics, July 1975 - December 1976: TCA Results for 18 Months of Usage"
    Jacques Vallee and Hubert Lipinski, March 1977, ITM-88.

"Annotated Transcripts for Eleven Computer Conferences in Geoscience, 1975 - 1976"
    Thaddeus Wilson and Gerald Askevold, April 1977, ITM-89.

"TCA: A Description"
    Hubert Lipinski, April 1977, ITM-90.